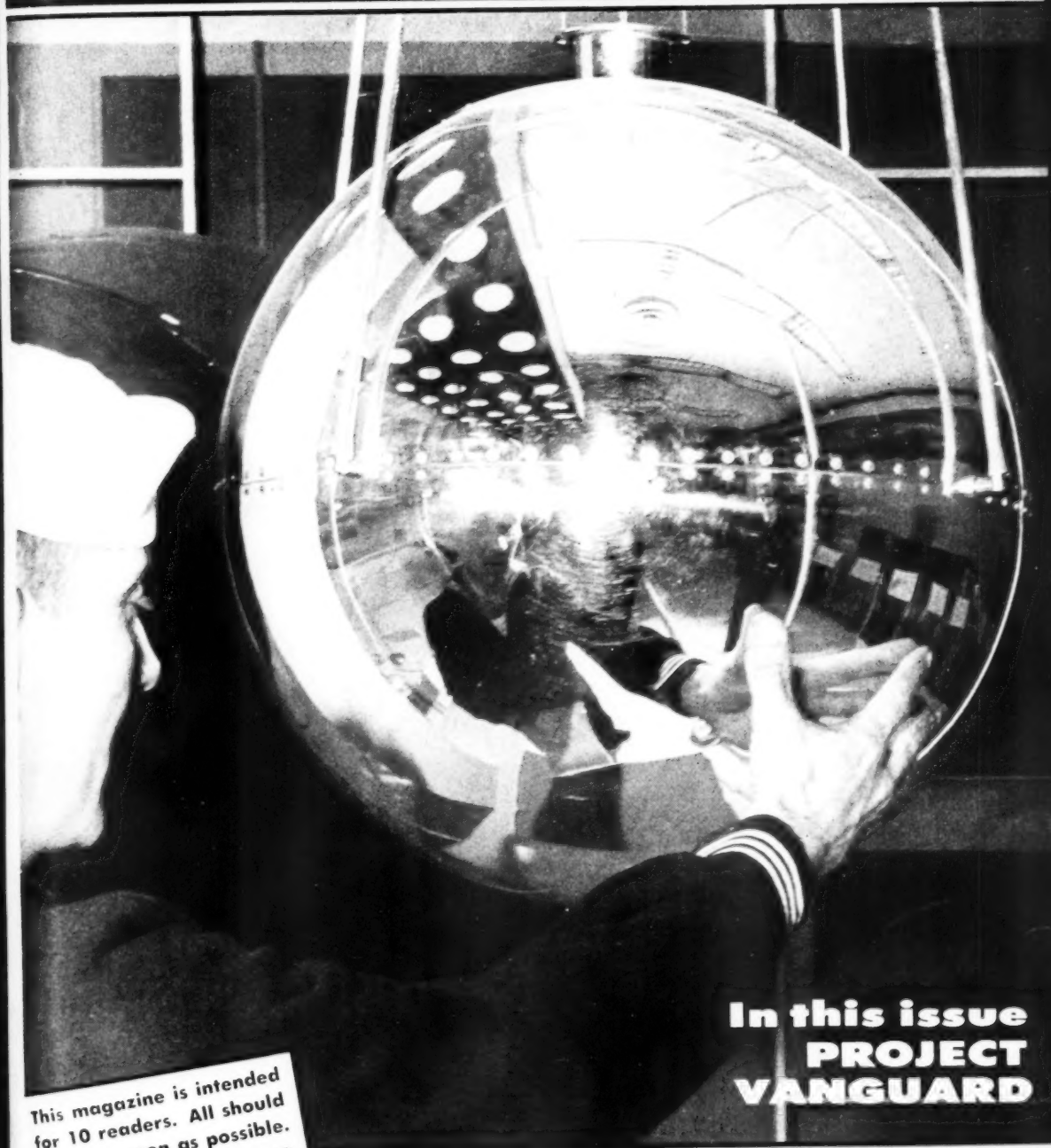
ALL HANDS



In this issue
PROJECT
VANGUARD

This magazine is intended for 10 readers. All should see it as soon as possible. PASS THIS COPY ALONG

DECEMBER 1957

ALL HANDS

THE BUREAU OF NAVAL PERSONNEL INFORMATION BULLETIN

DECEMBER 1957 Nav-Pers-O NUMBER 491

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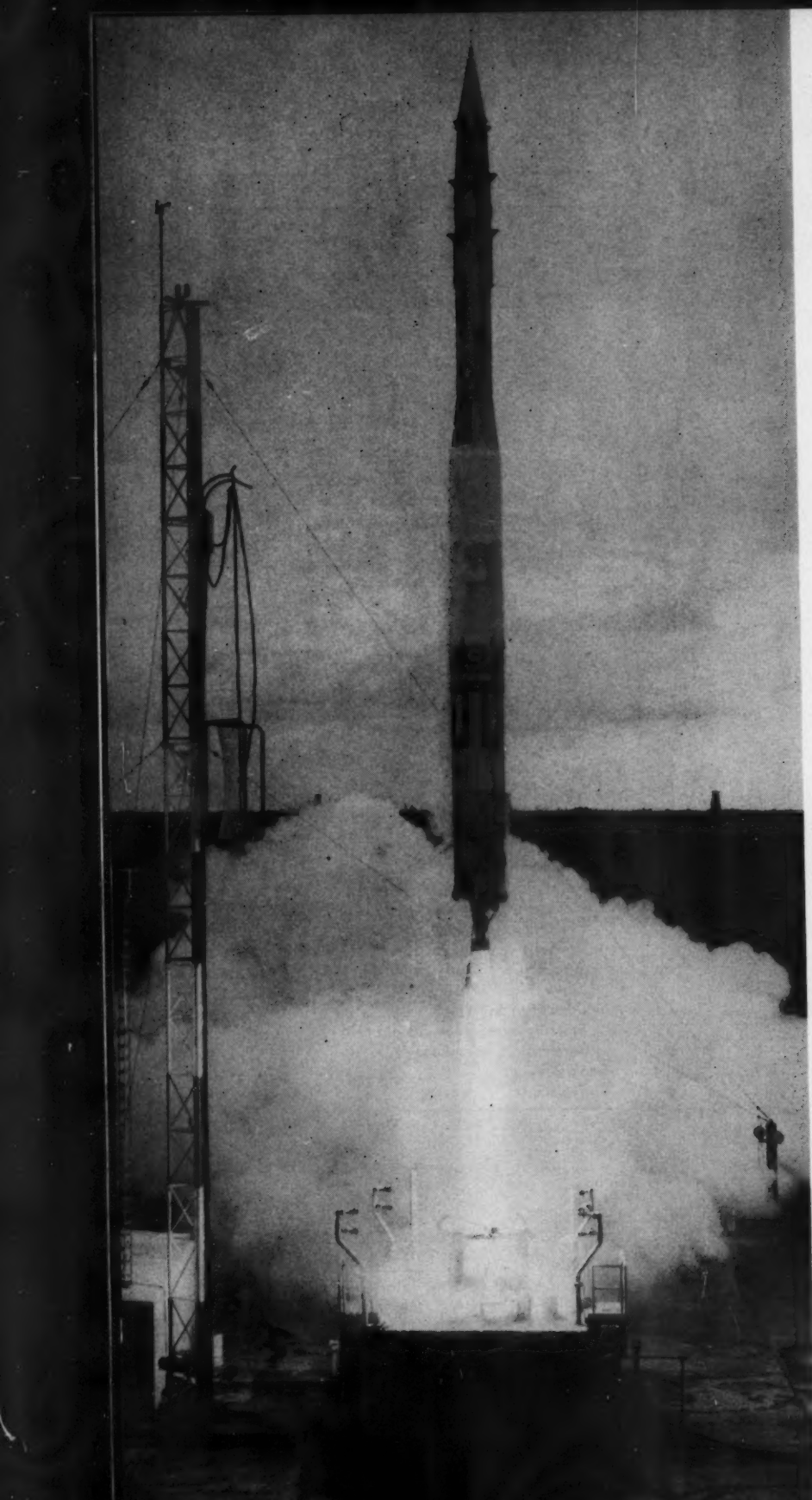
• **AT LEFT: LOOKING DOWN**—High-flying camera amidships in a Navy V-2 research rocket took this photo of the earth from 100 miles up. The picture, taken over 10 years ago, shows southwest U. S. and Mexico including Gulf of California, Southern Calif., and Pacific Ocean near the horizon.



With artificial satellites or "man-made moons" receiving world-wide attention in recent months, ALL HANDS *presents herewith an up-to-date factual report of* Project Vanguard*—the Department of Defense phase of the U.S. Earth Satellite Program and the Navy's role in it—being carried out during the International Geophysical Year (1 July 1957 to 31 December 1958).*

TO UNDERSTAND HIS PLANET, man must rise above it.

That, in simple words, is the reason for satellites and space research. Today, man knows little about the cosmic forces which affect our lives, as they are hidden from study by the heavy blanket of air surrounding the earth. Therefore, before man can learn about the mysteries of space and how they affect our lives, he must be able to penetrate the atmosphere.

In the past, rockets, balloons and a combination of both (see page 17, ALL HANDS of Jan 1957) were the only means of going beyond the atmosphere to get a closer look at outer space. And although Navy

REPORT

rockets and balloons have collected a large amount of valuable data during the past 10 years, their usefulness to date has been limited.

Balloons can remain aloft for several hours but they cannot go high enough to obtain the desired information. To date, the highest balloon ascent has been 143,000 feet. That's above more than 99 per cent of the earth's atmosphere, yet not high enough. At these heights—27 or 28 miles—the air is too thin to support even gas-filled plastic balloons.

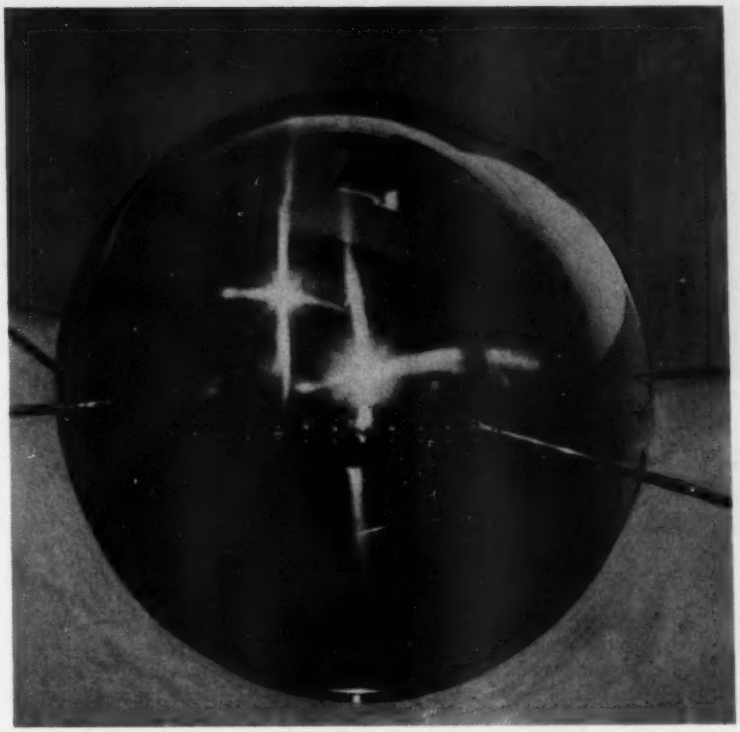
For research above the 143,000-foot mark, the Navy has had to depend upon rockets. The Naval Research Laboratory has sent *Viking* rockets as high as 158 miles, and other research rockets, such as the *Aerobee*, have consistently gone up 70 miles.

Although rockets can go high, they can't stay up. They are capable

VANGUARD rocket soars skyward carrying dummy second and third stages during recent Florida tests.

of collecting data above one location and for only a matter of minutes—before falling back to earth. The longest *Viking* rocket flight to date, for example, lasted only 10 minutes, from the time launched until landing.

If you took all the data collected during rocket experiments conducted in this country during the past 10 years, it would add up to less than an hour of useful observations. It is apparent, then, that a means of conducting high-altitude research continuously for long periods of time is needed.



THE ONE METHOD of doing this was by establishing observation "platforms" in space. Since manned flights into space are still a thing of the future, the only way to provide such a platform is to place a man-made, instrumented satellite into an orbit around the earth. A satellite—placed in orbit by rocket techniques—appears to be the only solution for lengthy research in space at this time. Satellites provide opportunities never before available for scientific measurements of the upper atmosphere. Satellites greatly increase the time available for gathering information over large areas because their life will not be limited to mere seconds, or minutes, but to hours, days, weeks and even possibly months and years.

ON PROJECT VANGUARD

After taking all this into consideration—and realizing that satellites would be a logical step beyond rocket and balloon studies and a giant step into space research—the United States, on 29 Jul 1955, announced that it planned to launch small, un-manned earth-circling satellites as part of its participation in the International Geophysical Year.

The Scientific Earth Satellite Program, like the other scientific projects the U.S. is performing during the IGY, is under the sponsorship of the National Academy of Sciences and the National Science Foundation (See pages 34-39 for a rundown on the Navy's role in support of the IGY).

The U.S. Scientific Earth Satellite Program, as outlined by President Eisenhower, calls for the launching of an instrumented sphere in an orbital path above the atmosphere of the earth strictly as a scientific venture. But, because of the vastness of this project, and because the Department of Defense had the talents and facilities for carrying out the launching of the satellite, it was asked to lend a hand. This is how the Navy got into the satellite program.

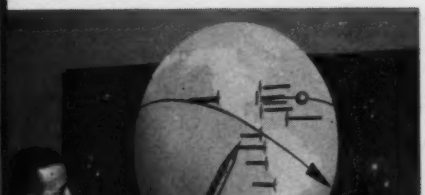
When the satellite program was announced, no one knew exactly how the task was to be done. No similar project had ever been undertaken before. The Navy, however, had a good idea as to what this project would involve as it had been probing space and conducting high-altitude research with rockets and balloons since the end of World War II.

THE DEPARTMENT OF DEFENSE'S role in the U.S. satellite program, called Project Vanguard, was set up as a joint Army-Navy-Air Force program. However, on the basis of the Naval Research Laboratory's rocket development and 10-year experience in high-altitude research, the Navy, specifically the Chief of Naval Research, was selected to manage Project Vanguard.

In this joint three-service effort, the *Navy* is providing the launching vehicle and the satellite spheres; the *Army* is setting up and manning the radio tracking and telemetering stations; while the *Air Force* is providing the launching facilities and will also operate some of the tracking and telemetering stations.

While RADM Rawson Bennett, USN, Chief of Naval Research, has the over-all responsibility for the Navy's and the Department of Defense's role in the U.S. Satellite program, a top civilian scientist, Dr. John P. Hagen of the Naval Research Laboratory, is the Director of Project Vanguard.

It has been under Dr. Hagen's guidance that the Naval Research Laboratory has gone about the technical job of getting the man-made satellite into its orbit. All in all, this was a big job and it presented a tremendous challenge to the Navy. Great progress has been made in the 30 months since the plans for Project Vanguard were announced.



SATELLITE, launcher, orbit, and tracking stations, are demonstrated by Dr. Hagen, Director of Vanguard.

An operation as complex as launching a delicate scientific satellite into space cannot be undertaken without an extensive series of careful, detailed tests in which every part is thoroughly tested. The structure, motors, guidance and control mechanism and their electronic components must be thoroughly checked out.

These tests are continuing and from all indications the Navy will, as committed, place a satellite in orbit during the IGY now underway.

WHEN TESTS of the third stage of the satellite's launching vehicle proved successful, the Navy decided to place six-inch spheres equipped with radio transmitters into its four test vehicles. If any one of these test vehicles goes through all of its tests satisfactorily, the six-inch sphere could go into orbit. There are four six-inch spheres scheduled for test flights within the next three months.

If these tests are satisfactory and development proceeds according to schedule, the Navy will make its first attempt to place a fully instrumented 20-inch satellite into orbit in March 1958. This schedule, however, is subject to change depending upon the results of the test program. The Navy will attempt to launch at least six fully instrumented (20-inch) satellites into orbit before the end of the IGY.

Although weighing only 21½ pounds, it will take more than 11 tons of rocket and fuel to get this sphere—not much bigger than a basketball—into its orbit. The launching vehicle will be a three-stage Vanguard rocket, 72 feet long. (See page 32.)

To get a satellite into its orbit it must travel between 18,000 and 25,000 miles per hour when separated from its launching vehicle. If it goes faster, it would shoot off into space; slower, it would fall and burn up like a meteor.

The satellite's orbit will not be a perfect circle around the earth. Its speed will be slightly more than enough for a circular orbit. It will be an ellipse—roughly egg-shaped.

HOW LONG THE SATELLITES will remain aloft depends upon how high they will be fired. According to Naval Research Laboratory calculations, a satellite in a circular orbit 300 miles above the earth would stay up about a year or more. A circle 200 miles up would give a lifetime of about 15 days, and 100 miles up its lifetime would be only about one hour.

Another factor determining the life of the satellite would be the density of the atmosphere. This is a puzzler, as scientists don't know as yet how dense the atmosphere is at levels above 150 miles. It's something they hope to learn from satellites.

Getting the satellite into its orbit is just one phase of the Navy's overall job in Project Vanguard. Once it begins circling the earth, the Navy must prove the man-made moon really is orbiting and measure its orbit. In other words, the satellite must be tracked. This will be done by two methods. The first will be by a radio tracking system known as Minitrack, developed by the Naval Research Laboratory.

A sub-miniature radio transmitter inside the satellite will send out signals that will be picked up by a series of tracking stations. (See page 5.) Each of these stations will be able to analyze data on the direction and the velocity of the satellite from signals received by its antennas, and will send this data to the main Vanguard Computing Center in Washington, D. C. Here electronic computers will calculate the times of future passages of the satellite over various points, and this data will be sent out to observing stations that hope to pick up the satellite and track it with optical instruments.

The second method of tracking

President Eisenhower on the Satellite Project

"The United States satellite program has been designed from its inception for maximum results in scientific research. The scheduling of this program has been described to, and closely coordinated with, the International Geophysical Year scientists of all countries.

"As a result of passing full information on our project to the scientists of the world, immediate tracking of the United States satellite will be possible, and the world's scientists will know at once its orbit and the appropriate times for observation.

"The rocketry employed by our Naval Research Laboratory for launching our Vanguard has been deliberately separated from our ballistic missile efforts in order, first, to accent the scientific purposes of the satellite and, second, to avoid interference with top priority missile programs. Merging of this scientific effort with military programs could have produced an orbiting United States satellite before now, but to the detriment of scientific goals and military progress.

"Vanguard, for the reasons indicated, has not had equal priority with that accorded our ballistic missile work. Speed of progress in the satellite project cannot be taken as an index of our progress in ballistic missile work.

"Our satellite program has never been conducted as a race with other nations. Rather, it has been carefully scheduled as part of the scientific work of the International Geophysical Year.

"I consider our country's satellite program well designed and properly scheduled to achieve the scientific purposes for which it was initiated. We are, therefore, carrying the program forward in keeping with our arrangements with the international scientific community."... President Dwight D. Eisenhower.

the earth satellite is through visual means. This optical tracking program, which will be particularly useful after the transmitter runs down, is being conducted by the Smithsonian Astrophysical Observatory and is not a part of Project Vanguard.

THE ULTIMATE PURPOSE of Project Vanguard is to create a satellite for scientific research. Many experiments could be devised for an earth satellite. In the case of Vanguard, however, the small size and payload must be kept in mind. Roughly half of its 21.5 pounds are absorbed in the satellite's structure. This leaves about 10 pounds for sicentific instruments. Some of this weight must go into the Minitrack transmitter and a power supply, which will consist of batteries.

Tracking the satellites will enable scientists to make better measurements of the size and shape of the earth, and distances between points of the earth. This will be one of the satellite's scientific experiments.

A second output of the tracking program will be measurement of the drag on the satellite. From this, the density of the atmosphere at that height can be figured.

Scientists also want to measure temperatures on the outside and inside of the satellite. Miniature temperature gauges have been designed that can evaluate temperature changes from 302 degrees above zero, Fahrenheit, to 220 degrees below zero, Fahrenheit.

Another piece of equipment designed for satellite instruments is a sub-miniature meteoritic collision microphone. This sensitive little microphone detects the collisions of meteorites with the satellite by sensing vibrations set up in the satellite's outer surface. This information will be stored in a memory device and transmitted at intervals to the radio tracking stations on the ground.

Ultraviolet and X-rays from the sun will also be measured. This information will be compared with weather and radio communication conditions on earth at the same time, to see if there is any apparent correlation.

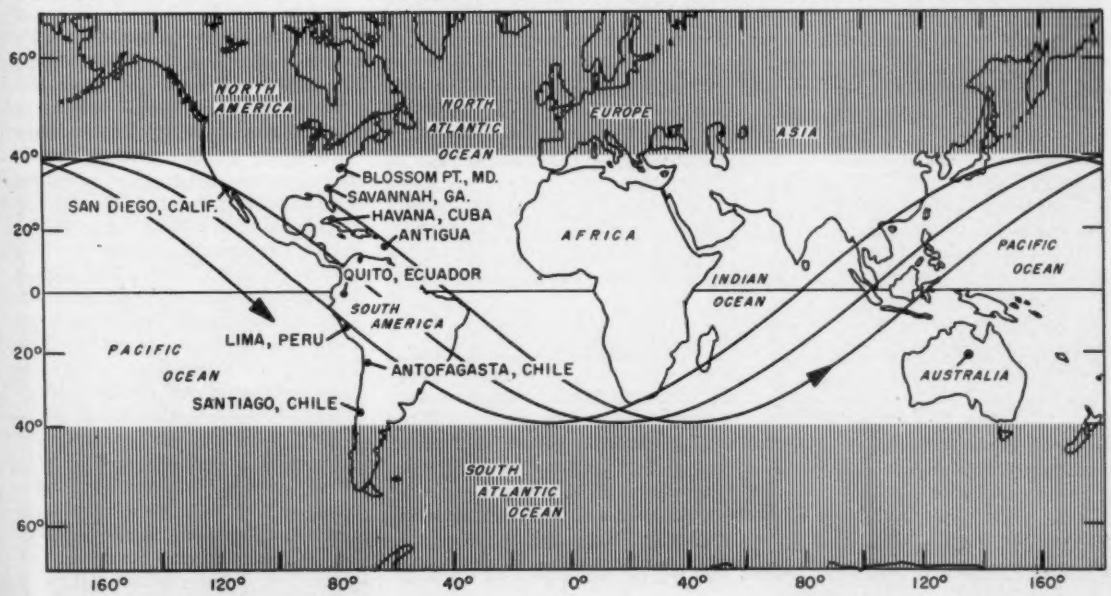
Certain instruments will measure the Earth's magnetic field above the atmosphere. By comparing this data with measurements on the ground, scientists will be able to find out more about the effect of current rings far out beyond the atmosphere. Such a ring is formed by the Earth's permanent magnetic field from charged particles that come from the sun. This knowledge will be important in the field of radio communications.

THESE ARE JUST A FEW of the experiments which the satellite will be called upon to perform. Even with the small payload permitted in a 20-inch satellite, measurements can be carried out for several weeks with conventional batteries.

TEST SATELLITE sits in its position in nose cone. Window-like objects are solar batteries providing sun power.

The technical complexities involved in the design and construction of the Vanguard rocket, the satellites themselves and its launching devices were enormous. To place the satellite into its orbit where it will record and transmit information to radio receiving stations, the Navy

KEEPING TRACK—Chart shows Minitrack locations in Americas and Australia and their relation to satellite orbits.



found it necessary to draw upon the skills and resources of over 100 different industrial and scientific organizations throughout the country. Here's a partial list of some of the scientific and industrial achievements which have been coordinated by the Naval Research Laboratory for Project Vanguard:

• THE VANGUARD ROCKET—A three-stage launching vehicle capable of carrying a 21½-pound satellite into its orbit 300 miles above the earth. The *Vanguard* rocket is 72 feet over-all, weighs 11 tons, and is equipped to launch the satellite at a final speed of 18,000 miles per hour.

• THE FIRST-STAGE ENGINE—Produces more than 27,000 pounds of thrust to lift the 22,000-pound launching vehicle to a height of 36 miles. At burn-out time this power plant will have accelerated the rocket to a speed of 4,000 miles per hour in approximately 140 seconds.

• THE SECOND-STAGE ENGINE—Takes over after first stage burn-out. It will push the second and third stages to an altitude of about 300 miles.

• THE THIRD-STAGE ROCKET—Ignites after second stage burn-out to accelerate the third stage to a speed of 18,000 miles per hour (or five miles per second).

• RETRO AND SPIN ROCKETS—Used to separate the expended second stage from the third stage. Spin rockets spin the third stage like a football to give it greater directional stability.

• THE SEPARATION MECHANISM—This device ejects the earth satellite from the third stage rocket after both are established in the orbit. It consists of a large coiled spring, triggered by a timer.

• THE PROGRAM TIMER—This contains a specially coded steel tape which holds complete flight instructions for the launching vehicle.

• COASTING TIME COMPUTER—Is a compact electronic calculator which senses the correct moment to fire the third and final rocket stage.

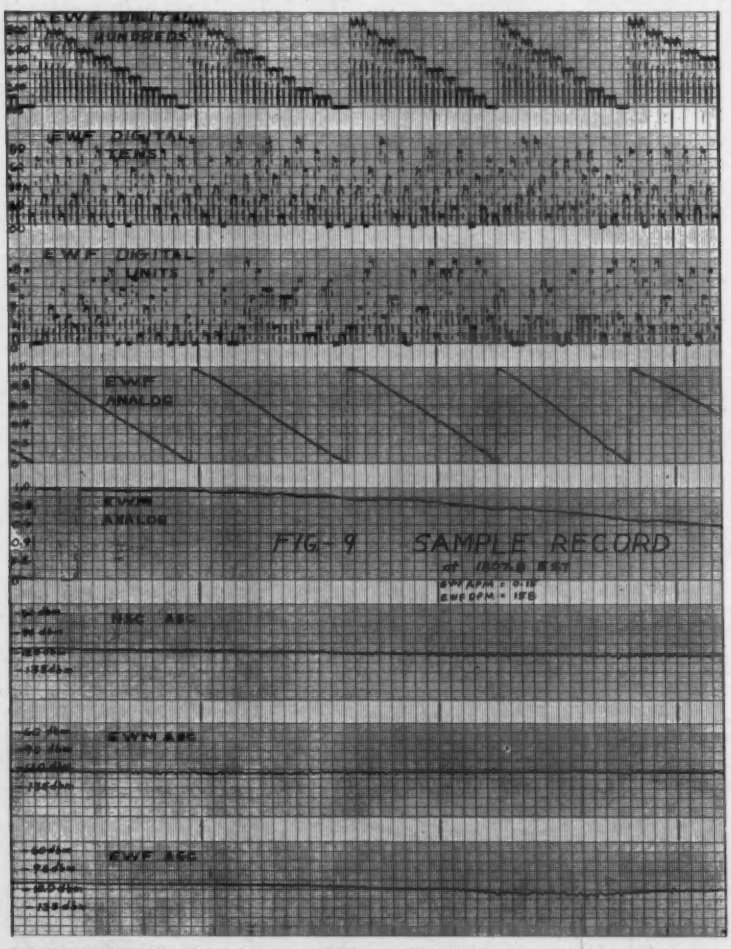
• GYRO-REFERENCE SYSTEM—Is used to detect errors in the flight of the rocket. It sends corrective signals to an autopilot amplifier to guide the second and third stages into the proper orbit.

• MAGNETIC AMPLIFIER AUTOPILOT—Obtains pitch, yaw and roll axis displacement signals from the Gyro-Reference System. The electrical output power directs hydraulic actuators which in turn displace the rocket motor and its thrust line for pitch and yaw control.

• ARTIFICIAL EARTH SATELLITE—This is the 21-inch sphere which will contain the scientific instruments to measure phenomena above the earth's atmosphere. Its shell consists of two hemispheres and certain structural parts. The "skin" is a magnesium alloy, .028 inches thick in most areas and thinly plated with gold, chromium, silicon monoxide, aluminum, and an additional coating of silicon monoxide.

• MINITRACK RADIO TRACKING EQUIPMENT—Is designed to pick up signals from the satellite's tiny subminiature transmitter. The Minitrack equipment was designed and developed by the U. S. Naval Research Laboratory. Signals from the satellite are picked up by the Minitrack stations on the ground (see page 16). This information will be relayed to the Vanguard Control Center at the Laboratory to be screened before being transmitted to the Computing Center where the data is used to determine and predict the satellite's orbits. The Minitrack radio tracking equipment picks up radio signals from the satellite through a unique antenna design and ground arrangement. The antennas are placed in a formation resembling a cross and cover an area of 500 to 1000 feet.

The development of these items, which are just a small portion of the over-all needs of Project Vanguard, represents countless thousands of man-hours in scientific and engineering research, as well as the total of man's limited knowledge of space. —H. George Baker, JOC, USN



SPACE WRITING—Signals received from Minitrack transmitters will be recorded on paper and look similar to this. Info will be 'translated' by scientists.

BIG BLASTERS—First-stage engines are tested at plant. Open end of thrust chambers are covered to keep out dust.

How Can Rockets Operate in Space?

WHY WERE ROCKET ENGINES selected to drive into space the Vanguard rocket bearing our earth satellite? Simply because they are the only power system now available that can operate in space.

Every type of combustion engine now in use requires oxygen. Under normal conditions, piston and jet type aircraft are able to remove from the atmosphere the amount necessary to support the combustion of fuel. However, as the plane goes higher and higher above the earth's surface the oxygen becomes less and less. If a plane were to reach, for example, a 15-mile altitude, the amount of oxygen in the air could not support combustion in even the most advanced type of supercharged piston engine. The jet would be gasping for breath.

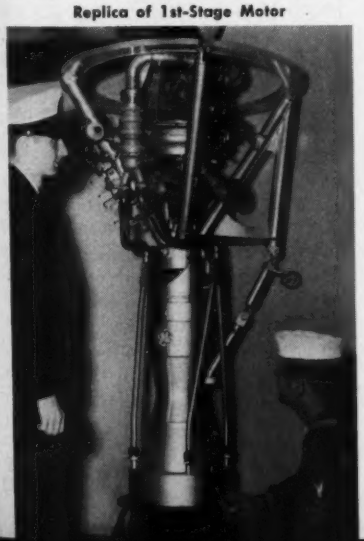
The rocket, which does not depend upon atmospheric oxygen for combustion, can continue on into space without hesitation, rising on its own exhaust and carrying both fuel and an oxidizer to burn the fuel in its tanks. In Vanguard, liquid oxygen supports the burning of rocket fuel in the first stage rocket motor and nitric acid in the second stage. The third stage rocket, which fires at an altitude of 300 miles where air is almost nonexistent, has a solid propellant motor.

Solid fuel rockets, in recorded use since 1232 A.D., have reached a state of maturity after proving their military worth during World War II (Army *Bazooka,* Navy *Tiny Tim,* German *Minenwerfer;* and Russian *Katusha* are all examples of solid propellant rockets used in the war).

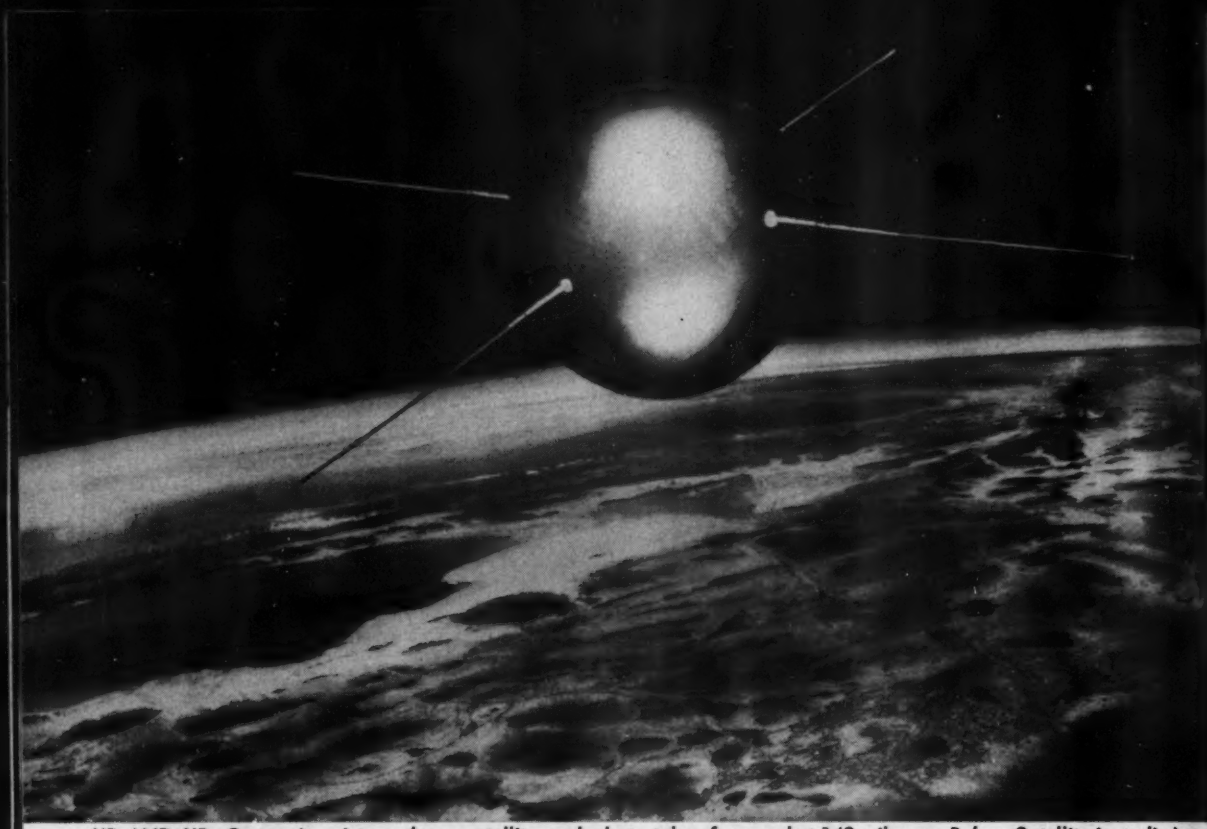
The liquid fuel rocket such as the Vanguard first- and second-stage engines, is the infant power unit in the rocket family. The most famous liquid rocket was the German *Vergeltungswaffe-zwei* — the V-2 of World War II. However, the first flight of a liquid-fueled rocket was in 1926.

The Vanguard rocket's 27,000-pound thrust will some day seem small, when rocket motors developing more than 100,000 pounds of thrust move from their present experimental stage into one of advanced development.

Replica of 1st-Stage Motor



Replica of 2nd-Stage Motor



UP AND UP—Composite picture shows satellite and photo taken from rocket 143 miles up. *Below:* Satellite is studied.

NAVY'S SATELLITES ARE

ACCORDING TO THE dictionary, a satellite is an attendant attached to a prince or other powerful person; hence, a follower. However, satellites also have a secondary or astronomical meaning.

Natural Satellites

So far as astronomy goes, a satellite is a celestial body or secondary planet which revolves around a larger body or planet. The planets Earth, Mars, Jupiter, Saturn, Uranus and Neptune each have one or more satellites.

The earth's only astronomical satellite is the moon. The earth is the larger body (it's four times as big as the moon) and is about 239,000 miles away from the moon. The earth rotates on its axis close to 1000 miles per hour and the moon circles around the earth about once every 28 days. It travels at a speed of approximately 2300 miles per hour.

Man's Satellites

A man-made satellite then, is an object made by man and thrown into space so it will circle the earth

somewhat in the same manner as the natural moon does.

The U.S. Navy will attempt to launch 10 man-made satellites during the current IGY. Four of them will be tiny "moons" measuring 6.4 inches in diameter and weighing about four pounds. The remainder will be somewhat larger—about the size of a medicine ball—20 inches in diameter and weighing 21½ pounds.

These man-made satellites will travel at a speed of 18,000 miles or more per hour. At that speed, it will take only about 90 minutes to circle the earth.

How Will These Man-Made Satellites Be Launched into Space?

Before a man-made satellite could be launched into space, many obstacles caused by the earth's atmosphere and gravity had to be overcome. First, man had to figure a way of getting the satellite through the atmosphere without burning it up, and then getting it high enough so it would overcome the earth's gravitational force.

Since the air that blankets the earth thins out as you go higher and oxygen becomes scarce, winged flights into space are impossible.

READY

Rockets—which carry their own oxygen, need no wings, and are capable of traveling at almost unbelievable speeds—proved to be the only solution to these problems.

Since no rocket had previously been built as a satellite-launching vehicle, the Navy had to begin from scratch to build one. It designed and developed a 72-foot, finless, three-stage rocket that's shaped like a rifle bullet. At take-off, this Vanguard rocket produces 27,000 pounds of thrust—less than 5000 pounds more than its gross take-off weight which, including fuel, totals 22,600 pounds.

As fuel is consumed, the rocket's over-all weight is lessened and its thrust increases. In less than 140 seconds after launching—when the first-stage fuel has been exhausted and its casing dropped—the rocket will already have climbed to an altitude of 36 miles and will be moving upward at a speed of about 4000 miles per hour.

During this stage of the flight, the rocket's speed has been slow enough to prevent it from heating up and damaging the satellite. And at an altitude of 36 miles, the atmosphere is largely below; thus, the heat or atmospheric problems are taken care of as the air pressure is reduced and the resistance lowered.

The rocket's second stage eliminates the gravity problems as it carries the satellite to a height of 300 miles. At this point, the third stage is fired after the second stage gives it a spin around its axis in order to equalize the thrust of the solid rocket propellant of the third stage. The second stage drops off and the third stage increases its speed up to 18,000 mph or more, which is sufficient to overcome the earth's gravitational pull.

To complete the process of putting the man-made moon into space, the satellite is separated from the third-stage rocket engine by a spring mechanism which is actuated by a mechanical timer as soon as the third stage burns out.

When Launched, What Will Keep The Satellite from Falling or Going off into Space? How Fast Will It Travel?

When separated from the third stage of its launching vehicle, the satellite will be flying horizontally in a chosen orbit around the earth between 18,000 and 25,000 miles per hour. If it went faster, it would shoot off into space; slower, it would fall. At this speed, the satellite maintains a perfect balance between the force of gravity pulling it toward earth and the centrifugal force resisting this pull.

To illustrate this, take the circus or carnival stunt rider who rides his motorcycle around the side of a motor-drome. In order to stay up on the side of the perfectly balanced circular tank the motorcycle must travel at an exact constant speed. If he goes too fast, he'll shoot out over the top of the tank, and if he slows down, his motorcycle will fall to the bottom.

Like the motorcycle, the satellite must maintain a perfect and constant speed as it circles the earth in order to stay up. According to Newton's second law of motion—which states that once a body is set in motion, it will remain in that state unless some

INSIDE JOB—Plastic model shows how instruments will go into space sphere.

UPPER PLATE—Satellite is checked before special plating that will protect it.

force changes it—the satellite's speed of 18,000 mph or more should remain constant for quite some time. Where there are no outside forces working against the satellite's forward motion, it can continue to travel at that speed indefinitely.

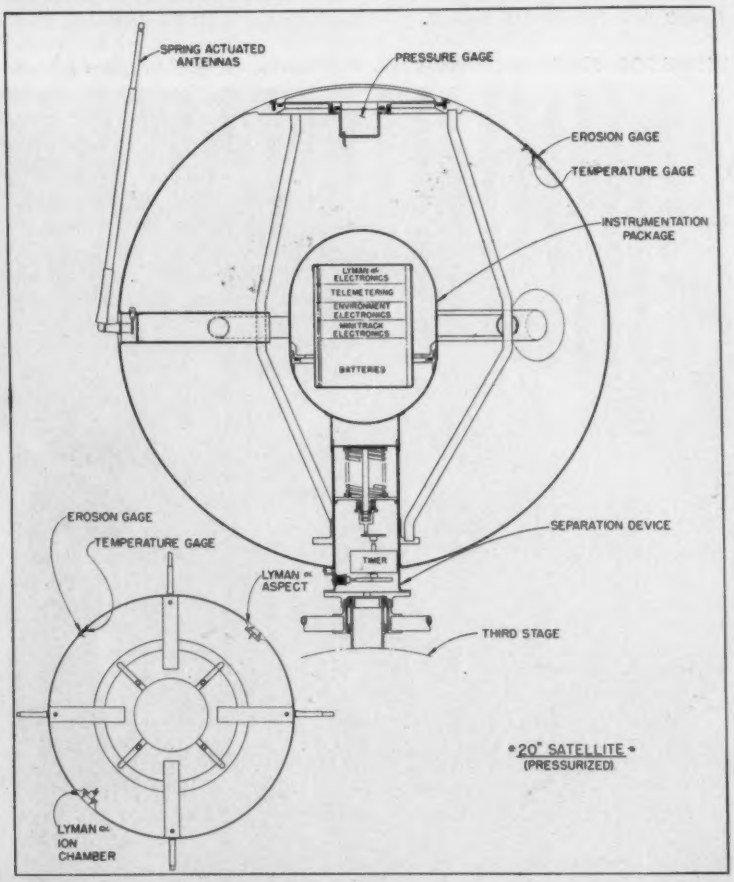
The satellite's chosen orbit is a nominal circle 300 miles above the earth's surface. Owing to errors in height, angle and velocity during launching, the satellite's orbit will be elliptical rather than in a perfect circle. In an elliptical orbit, the satellite might swing as low as 200 miles above the earth, but then will ride out as far as 1500 miles.

Will These Man-Made Moons Stay Aloft Forever?

No, not forever. But exactly how long, no one can predict. How long a satellite will stay aloft depends upon the altitude of its orbit. If launched beyond 300 miles, they should whiz around the earth for a year or more; 200 miles, about 15 days, and if only 100 miles, their life span will be limited to an hour or two at the most.

Another factor in determining the life of a satellite is the density of the atmosphere. As yet, scientists don't know just how dense the atmosphere is beyond 150 miles. That's something they hope to learn from the satellites.

As said earlier, the man-made moons will not stay up forever. The age-old adage—what goes up, must come down—applies to satellites, too. As time goes on, the drag of the air, thin as it may be at 300 miles, meteor dust and other factors will eventually cause the satellites to slow down. When they lose speed they will also lose their centrifugal force and the earth's gravitational pull will make them fall back into the atmosphere.



Will Falling Satellites Present any Danger?

The satellites the U. S. plans to launch during the IGY will present no danger when they fall from space. By the time they return to the earth's surface they will be no more than microscopic specks of dust. As the satellite loses speed and falls into the earth's atmosphere, air friction will cause it to burn up. It will burn and create a glow in the same manner as tiny meteorites or shooting stars, which are so often visible at night.

How Is a Satellite Tracked Once It's Launched into Orbit?

As the tiny satellite circles the earth, it is tracked by a system of radio angle tracking called "Minitrack." The Minitrack system and its equipment was developed by the Naval Research Laboratory.

This radio tracking system is built around a very small transmitter within the satellite. It sends a beam of radio energy to receiving antennas at 10 different ground stations. A chain of these Minitrack stations has been established up and down North and South America from Blossom Point, Maryland to Santiago, Chile; with stations located also at Antigua, B.W.I., and Woomera, Australia.

Minitrack, during the initial orbit,

will localize time of arrival of the satellite over any given ground location within six minutes, and will give its position within several hundred miles. This information will be accurate enough to alert visual tracking stations, as to the time and position of the satellite over their location.

In addition to tracking the satellite in orbit, the Minitrack system also enables scientists to follow the satellite's launching, direction of launch and movements of the second and third-stage rockets. (For more on the tracking system see page 16.)

Can These Tiny Man-Made Moons Be Seen as They Circle the Earth?

Under clear atmospheric conditions you should be able to see them fairly well with a good pair of binoculars or a modest astronomical telescope. If you look closely enough, you may be able to see the satellites with your naked eye. That is, if you are in the right place, at the right time and know which direction to look. This information will be available as a result of information received through the Minitrack system.

The satellite is as bright as a star of the fifth or sixth magnitude. The best time to observe it will be about an hour before sunrise and an hour after sunset. (No chance of getting sunburnt but watch out for those stiff necks.)

Thirteen prime astronomical observatory stations have been established in different parts of the world to photograph the satellite's position in orbit in relationship to known positions of the stars. In addition, there are about 200 secondary stations and many amateur stations making their own physical observations.

How Are Satellites Made?

Without getting too technical, here are a few simple instructions:

To make a satellite, you cut out a circular disc of magnesium, put it on a lathe and "spin" and disc it into a hemisphere. This process is repeated for a second hemisphere. Then the two are fastened together (with screws). It is in this sphere (which weighs about 10 pounds) that the compact radio, electronic- and data-gathering instruments are installed.

After the two hemispheres are fastened together, the 20-inch globe must be put through a coating process to prevent corrosion and aid in making temperature measurements. In all, five coatings must be applied.

First, the satellite is electroplated with gold to make the other surfaces adhere better and to stop corrosion. Gold, because of its low corrosive and low heat qualities, is also used to cover the inside of the satellite's structure.

After the gold plating, a thin layer of chromium is applied. Next a layer of silicon monoxide is put on to act as a barrier between the chromium and the fourth layer, aluminum. This prevents the dark chromium from diffusing into the bright aluminum.

The satellite's fourth layer, aluminum, makes it look like an oversize mirror-like Christmas tree ornament. This layer reflects the sun's heat and makes the satellite visible on earth. These first four coatings are no more than four or five millionths of an inch thick.

The fifth and final coating is another protective coating of silicon monoxide.

The man-made moons are also equipped with four radio antennas, somewhat like the ones on an auto. They snap into position when the satellite is released from its launching vehicle.

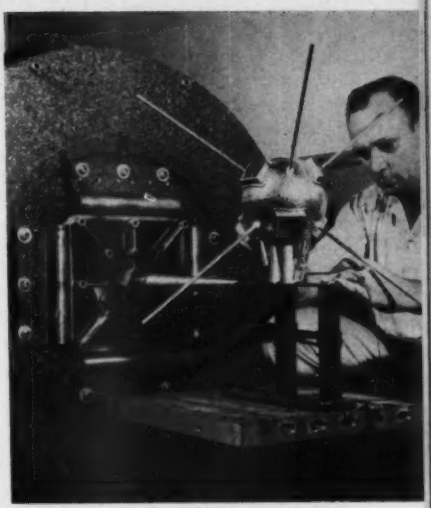
What Useful Purpose Will Satellites Serve?

As scientific research vehicles, the usefulness of satellites is limited only by man's imagination. Small as these man-made moons may be, scientists will gain much interesting information in the fields of astronomy, of geophysics, and information of geodetic value from them.

Satellite experiments include a study of ultraviolet radiation from the sun; studies of the magnetic field of the earth; studies of the intensities of primary cosmic rays coming into the earth from outer space and other studies of the atmosphere.

In addition to information about the upper atmosphere and the radiation it receives from outer space, satellites offer earthbound scientists a new and valuable way of looking at the world itself.

Information from satellites will give precise measurements between continents and islands as well as other topographic features. All this information will broaden man's knowledge of the universe in which he lives and will undoubtedly have many practical applications neither foreseen nor predicted today. However, it is known that basic satellite research will lead to benefits in the area of communications, which will be improved by a better knowledge of the earth's atmosphere. By the same token, this information will lead to better weather forecasting and to further conquests in medicine, physics, chemistry, astronomy and other sciences.



SHAKE, RATTLE and roll capabilities of sphere's instruments are tested on machine at Naval Research Lab.

If the Satellites Burn Up and Never Return to Earth, How Do Scientists Get All This Information from Them?

Information collected by the instruments within the satellites is stored up in a memory unit and telemetered to earth by radio. These coded signals are picked up by the Minitrack stations and later translated by Navy scientists.

What's the Connection between the Satellite and IGY?

Today, man and science are on the threshold of a new era in upper atmospheric research. We are now in the sixth month of the 18-month International Geophysical Year during which the world's community of scientists are conducting a series of spectacular global experiments in an effort to unlock the deeper mysteries surrounding the planet on which we live. Satellite ventures into space are among the experiments being conducted as part of the IGY. This scientific "year" began 30 Jun 1957 and will continue through 31 Dec 1958. —**H. George Baker, JOC, USN**

Three-Stage Rocket Will Launch Sa

THREE . . . TWO . . . ONE . . . FIRE! A finger hovers over a firing switch and then presses it, bringing life to a giant white rocket some distance away. Ever increasing amounts of fuel flow into its motor and with a burst of flame the Vanguard rocket begins to rise, higher and higher.

Its destination—SPACE.

Resting inside the Vanguard rocket's protective nose cone is a small round ball . . . . the U. S. earth satellite. The rocket's mission is to deliver that metal globe, packed with instruments, into an orbit some 300 miles above the earth and impart to it a speed of 18,000 mph.

To accomplish this, American scientists working with the Navy created the Vanguard rocket which stands 72 feet high and is 45 inches in diameter. Packed into the cylindrical shell are two liquid rocket motors and one solid propellant rocket, the power sources which will carry the 21-pound satellite into space.

Scientists term the Vanguard propulsion device as a three-stage rocket. In other words it will use three different power units to provide the propelling force during various phases of the space voyage. The first unit is the largest, for it must break the grasp of earth's gravity and must force the slim, bullet-shaped rocket through the thick lower atmosphere. The second stage will carry the satellite-bearing third rocket to the orbital altitude of 300 miles. This stage will carry the guidance system which directs the rocket as it moves through the curving trajectory.

THE THIRD STAGE WILL accelerate the satellite up to 18,000 mph before burning out. At that point, a spring actuated mechanism will throw the globe into its orbit around the earth.

The Vanguard rocket is at present in the third of seven stages of testing. Test vehicle *ZERO* (TV-0) was fired last year. This was a single-stage test using a *Viking* rocket which closely resembles the Vanguard rocket's first-stage. In May 1957, a successful two-stage test was held, using a *Viking* first-stage and a prototype of the third stage.

TV-2 used Vanguard's first-stage, but the second and third stages in the recent firing were dummies containing only test instruments. The test was undertaken after the Project Vanguard rocket's first stage had completed extensive ground tests. TV-2 allowed scientists to observe the first-stage engine under actual flight conditions, evaluate the instrumentation of the rocket, and make aerodynamic and structural studies of the complete external configuration of the Vanguard vehicle.

After TV-2, four test firings of the complete three-stage rocket are planned as preliminary stages of the satellite mission. In each of the tests, Vanguard will carry a test payload

NIGHT LIGHTS—Vanguard test rocket gleams under the lights while undergoing tests in preparation for launching.

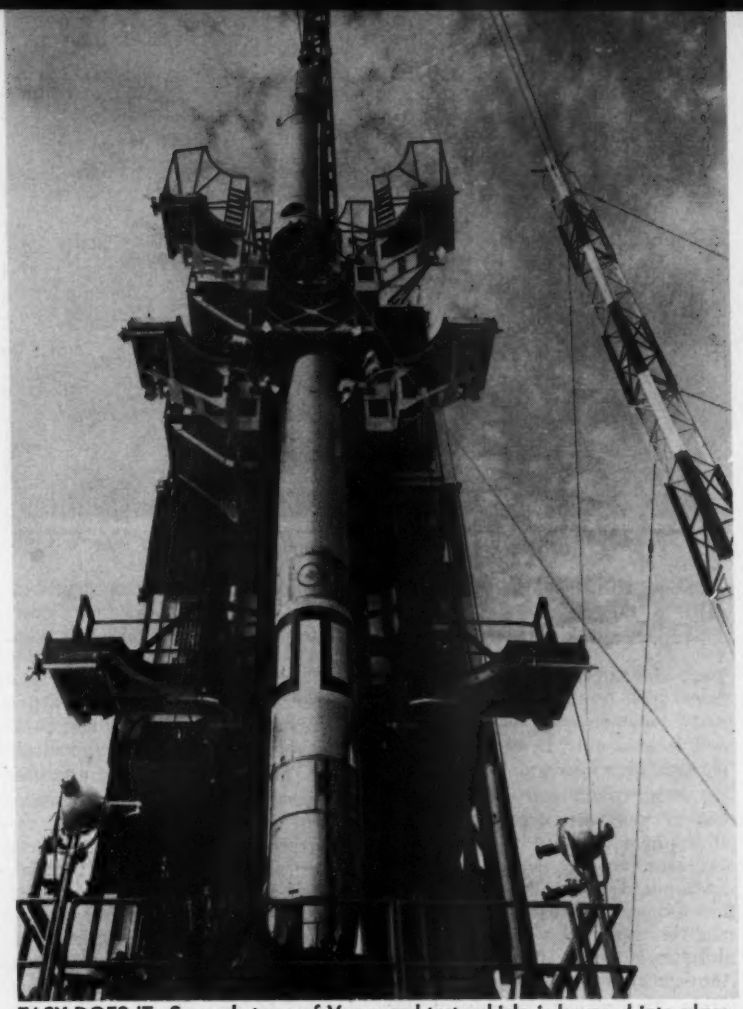
of an aluminum sphere, weighing about four pounds, which will be 6.4 inches in diameter. Each sphere will carry a Minitrack transmitter to permit tracking stations along the test range to measure the velocity of the sphere before and after the spring ejection.

DURING THE FLIGHT tests, which are being conducted at the Air Force Missile Test Center at Cape Canaveral, Fla., where TV-2 was fired, the Vanguard rocket will automatically radio back performance information to be processed and analyzed by scientists and engineers. Some of this data will be available to the technicians within hours after the rocket is fired, thanks to a new electronic brain known as the Automatic Recording and Reduction Facility (ARRF).

Housed in an instrumented mobile trailer near the firing stand, the digital data recording system will receive information and record it on magnetic tapes. The ARRF digests this material and prints it in the form of graphs and tables that can be used in evaluating the flight. Before the ARRF was developed it took weeks to reduce the data to usable form even though it was radioed back to earth from the rocket in a matter of seconds.

The Navy was assigned the task of developing the Vanguard rocket and the earth satellite following the President's announcement in mid-1955 that the U. S. would launch a satellite for scientific purposes during the International Geophysical Year (IGY). Within the Navy, the Office of Naval Research (ONR) both under contract and at the Naval Research Laboratory (NRL) had long been active in upper atmosphere studies (see page 24). NRL had been using high-altitude research rockets since 1946, and had fired 12 of the *Viking* rockets and numerous smaller *Aerobee* rockets. The Laboratory had obtained a great deal of valuable information in this manner that could be applied to the Vanguard program.

A three-stage rocket was decided upon as the Vanguard design. Some of the nation's leading scientists, its biggest industries, and the Navy's scientific labs were called upon to develop such a vehicle.



EASY DOES IT—Second stage of Vanguard test vehicle is lowered into place.

THEIR FIRST STAGE was a finless rocket of cylindrical design using integral fuel tanks, and of a "monocoque" type of construction. This type of construction called for the metal skin to be stretched over the frames and longitudinal members, leaving the interior free of braces and cross members that would have interfered with the installation of equipment.

The first-stage engine was designed to develop 27,000 pounds of thrust with an operating time of about 150 seconds, long enough to carry all three stages to an altitude of 36 miles before the first stage burns out and drops.

When the firing switch is thrown a pyrotechnic igniter fires, partially opening the liquid oxygen valve and, a short time later, the fuel valve. The two ignite in the thrust chamber and when satisfactory combustion is indicated the tanks holding hydrogen peroxide and a permanganate solution are opened and the mixing of the two produces a hot steam which is forced against the turbine blades of the turbo fuel pump. This pump forces large amounts of the liquid oxygen and fuel mixture into the thrust chamber where it ignites, bringing the motor to main stage (full power).

In theory a rocket works like the recoil of a shot gun which drives the butt into your shoulder when the shell explodes. If the gun were mounted on wheels the explosive force hitting against the breech would drive the gun back several inches. If repeated rounds were fired the gun would build up speed as the expanding gases pressed against the walls of the chamber seeking a path of escape. In the rocket motor, the burning fuel applies force to the walls of the thrust

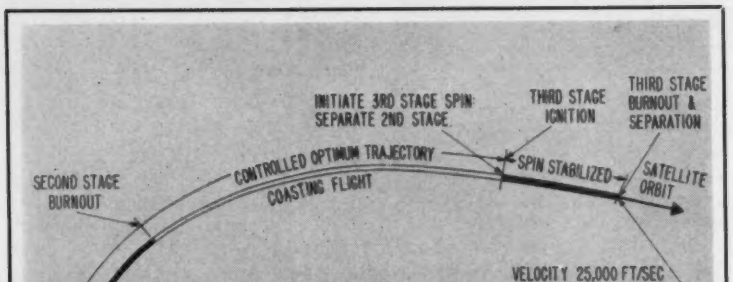


Diagram of satellite's flight

chamber, thrusting the rocket upward as the gases escape out the constricted nozzle of the motor.

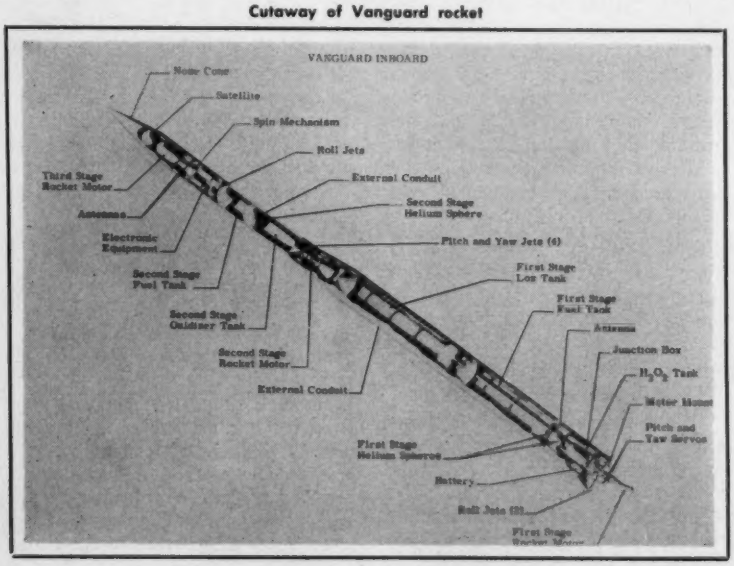
THE 27,000 POUNDS OF THRUST developed by the first-stage Vanguard motor will accelerate the vehicle at a rate of about 40-feet-per-second per second. At the firing, the acceleration is relatively slow, but as Vanguard rises into thinner atmosphere the rate of acceleration increases.

Vanguard's second stage, which provides the thrust necessary to take the third stage to the 300-mile altitude, is similar in design to the *Aerobee* rocket, but larger. Mounted inside the finless cylindrical air frame will be a liquid rocket engine which develops 7500 pounds of thrust using nitric acid and unsymmetrical dimethyl-hydrazine. (Don't ask for this at your local gas station. They don't carry it.)

The flow of the fuel and the oxidizer (nitric acid) into the thrust chamber is caused by forcing pressurized helium into the propellant tanks. The second stage also contains the complete guidance and control system which is used during the first three stages of the flight to space; first stage powered flight, second stage powered flight and second stage coasting flight.

Vanguard's rocket will be controlled by training the thrust of the motors up to a plus or minus five degrees in any direction from the center line of the vehicle. Both the first- and second-stage rocket motors are mounted in gimbals to provide this directional control. The mounting is similar to that used on ship compasses to counteract roll. The usual fins were discarded when experiments proved that they were useful only at low altitudes where the atmosphere is relatively heavy, while at high altitudes they only added weight.

Cutaway of Vanguard rocket



ACTIVATED BY GYROSCOPES, the movement of the engine will correct any variation in the flight direction of the rocket caused by wind gusts, uneven burning of fuel or changing center of gravity. The gyroscopes will also order changes in course dictated by the guidance equipment known as the Inertial Reference System sealed in the forward section of the second stage.

From the moment the rocket is launched this system records the ever increasing velocity and feeds the information to a master sequence controller which times and programs the flight sequence so that the rocket will follow the planned trajectory. The gyroscopes, one each for pitch, yaw and roll, spinning at 12,000 rpm in jeweled bearings, control the movements of the rocket motors as they guide the vehicle through the sky. As the master sequence controller orders a change of course, the memory circuit which controls the gyros is adjusted so that the pitch can raise or lower the Vanguard rocket's head as required.

ALSO INCLUDED in the second stage is the thick asbestos nose cone which will protect the satellite from the terrific heat generated during the flight through the lower atmosphere. Air cannot move out of the path of the rocket fast enough and is compressed, causing extreme heat which is transferred to the surface of the rocket. At higher altitudes where the air is very thin the nose cone will be discarded and the satellite exposed.

The third and last stage does not fire until the rocket has reached the proper altitude and is on a course that will put the satellite into the orbit around the earth. At that moment, the rocket fires again and the third stage will pull free to speed Uncle Sam's space station into its orbit. At the precise moment when the satellite is to be freed, a spring actuated mechanism separates the satellite from the third stage.

By this time, the first section will already have crashed into the At-

lantic Ocean some 230 miles away from Cape Canaveral, followed later by the second stage and the nose cone.

TO OBTAIN A TRUE PICTURE of what the aVnguard flight will be like, picture yourself in the control hut at the Missile Test Center on the east coast of Florida. You are surrounded by delicate instruments and the room is filled with a weird green light reflected from radar screens and the scopes of electronic equipment.

A slow and even chant records the passage of seconds as the moment of firing draws near.

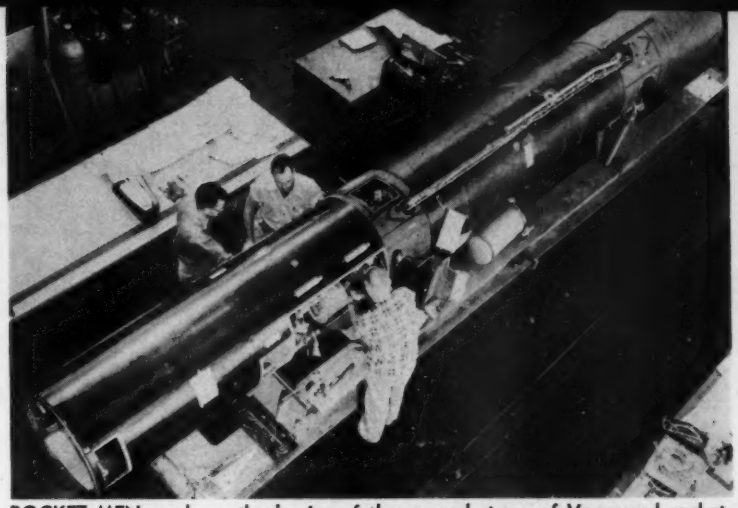
As the numbers fall lower and lower the multitude of red lights on the control panels switch to green showing that another phase of the automatic systems in the rocket is primed and, as the final light turns to green, the launching device is fired.

As the flaming blast of the rocket climbs toward main stage, the base of the device is clouded with steam coming from water coolant instantly boiled as it sprays against the rocket blast. The Vanguard vehicle climbs slowly. The first few feet are delicate ones, with the automatic controls striving to keep the 11-ton space vehicle in balance during its early vertical ascent.

The rocket enine in the first stage will accelerate Vanguard until the first engine exhausts its fuel or is automatically turned off after 150 seconds of flight. In the firing hut at this moment various electronic devices would tell you the rocket was at an altitude of 36 miles and traveling at a velocity of more than 3700 mph.

A RING OF EXPLOSIVE charges explodes in the rocket, detaching the dead first-stage from the second, which now comes to life. With the rocket climbing at an angle of 45 degrees the second-stage motor will drive the speed upward to 11,000 mph and the angle of climb will slowly be adjusted by the master sequence planner to 40 degrees and then lower as the rocket climbs toward the 300-mile level.

Before the power of the second-stage rocket motor is exhausted another sharp explosion will send the asbestos nose cone tumbling toward the ocean. At 130 miles the fuel is exhausted and the rocket coasts upward, its speed slowly dropping to 9000 mph as the earth's gravity clutches at the hull.



ROCKET MEN work on the brains of the second stage of Vanguard rocket. *Below:* Rocket blasts off into the night during tests at Cape Canaveral, Fla.

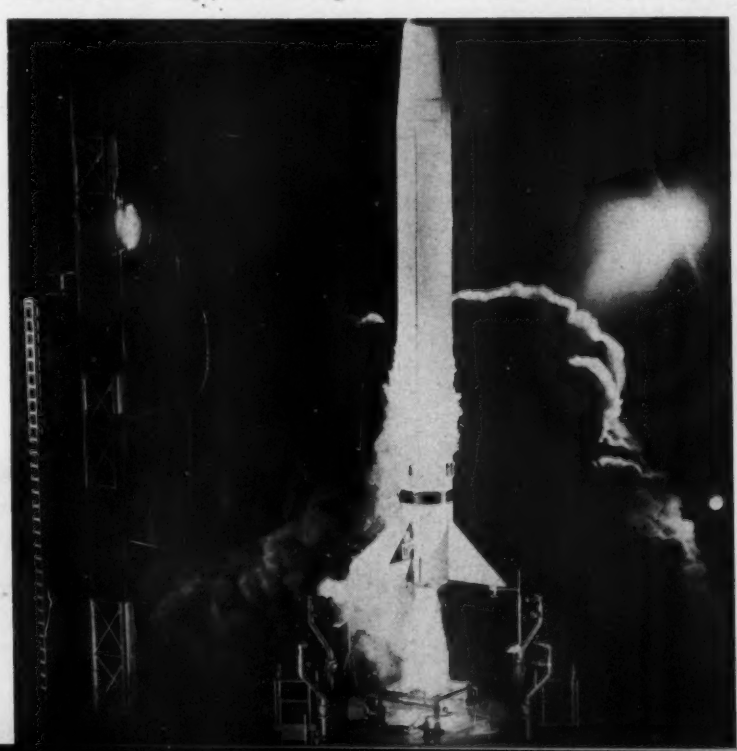
At intervals, small auxiliary jet reactors mounted along the body of stage two fire momentarily as the rocket starts a slight roll. The automatic controls are still keeping the rocket on a heading that will put the satellite into an orbit as close to the desired 300-mile trajectory as possible.

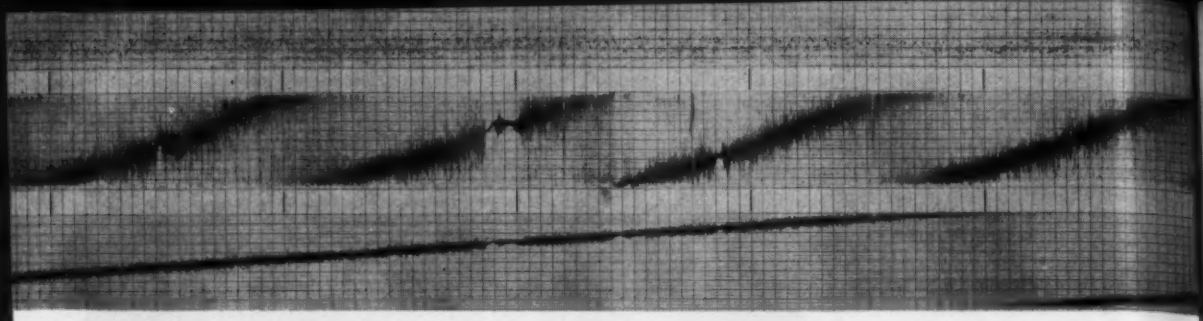
As the Vanguard vehicle slides into the orbit it follows a path parallel to the curvature of the earth. At the precise moment dictated by the "sequence programmer" small rockets (50-pound thrust) will spin the second and third stages to a speed of 200 rpm. Retrorockets on the hull of the empty second stage will blast in the opposite direction freeing the third stage from the second and firing the solid propellant rocket motor.

With the weight of the first and second stages gone, the third stage accelerates and within seconds its speed will have climbed until the satellite is being driven through space at the incredible speed of 25,000 feet every second or 18,000 mph.

As the last drop of third stage fuel burns, the spring mechanism pushes the 21-inch metal globe ahead of the exhausted rocket tube. Vanguard has completed its mission.

—William Prosser, JOC, USN





They'll Track Our New Moons

FROM THE MOMENT the earth satellite is launched from the Navy Vanguard rocket, thousands of "eyes" will be following it during its celestial wanderings, for if the tiny globe is lost nearly all of the scientific benefit to be gained from Project Vanguard will be lost with it.

The electronic eyes of radio will follow the satellite as it blazes new paths through space. Scientists will train telescope-cameras skyward to portray pictorially the passage of the man-made moon. Amateur astronomers will strain their eyes—and necks—to catch a quick glimpse of the metal moon as it travels around the world once every 90-or-so minutes.

The data gathered by these methods will be fed into giant electronic computers which will analyze the sighting information and the material gathered by radio to arrive at a minute-by-minute prediction of the orbit that will be followed by the satellite. In months to come this same material will be studied and restudied in an effort to learn what forces guided the scientific instrument during its life span—which may run into months or longer.

The problem of tracking the satellite is enormous. It will make about 15 revolutions around the earth every 24 hours, each one about 25 degrees farther to the west.

As the earth rotates on its axis the satellite orbit will climb to a point 40 degrees north of the equator and then fall an equal distance to the south. Sighting the speeding 20-inch sphere at its 300-mile altitude will be like trying to find an object the size of a golf ball traveling at the speed of sound some 60,000 feet up.

Two tracing programs have been included in the earth satellite project. The first and most important is the Minitrack system which uses ultrahigh-frequency radio wave measurements to determine the location of the "bird." The second system makes use of telescope-camera stations at 13 different locations which will record the path of the sphere in relation to the stars. This optical tracking program is administered by the Smithsonian Astrophysical Observatory at Harvard University which will also oversee Operation Moonwatch, a program in which volunteers will observe the passage of the satellite and record it on star maps.

Radio Tracking

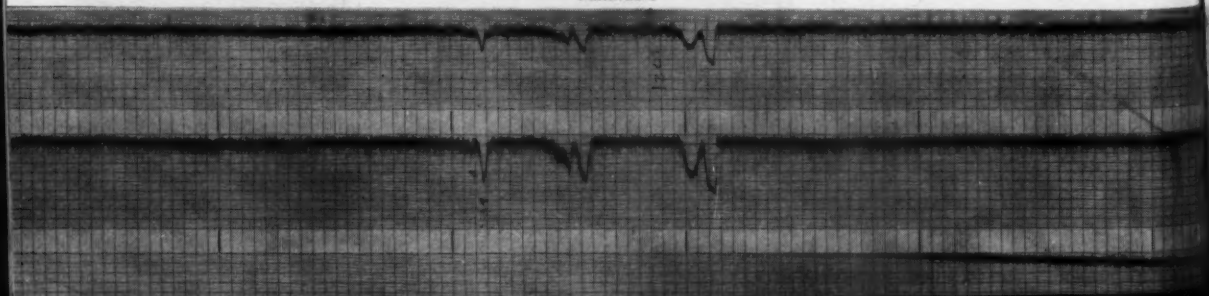
The radio tracking of the satellite will be the most important phase of the observation program during the first two weeks of the satellite life. During this period a miniature transmitter inside the globe will broadcast signals which will be received by a system of 10 Minitrack ground stations. By measuring the length of these signals the ground facility will be able to provide data to the computer concerning the track the satellite was following when it passed over the listening post, its altitude and speed.

Each of the Minitrack installations are scheduled to receive as many as four broadcasts a day from the satellite, with a minimum of two readings every 24 hours expected. After the installations have recorded an aggregate of six radio readings, the Vanguard Computing Center in Washinton, D. C., will be able to predict the orbit accurately enough for the optical observation stations to locate and to track the sphere.

Seven of the Minitrack facilities have been set up along the 75th Meridian where their vertical fan-shaped antennas will provide an invisible fence running north and south which the satellite cannot cross without disclosing its location. These Minitrack units are located at Blossom Point, Md.; Fort Stewart, Ga.; Batista Field, Havana, Cuba; Mt. Cotopaxi, Quito, Ecuador; Ancon, Lima, Peru; Antafagasto, Chile; and Peldehue Military Reservation, Santiago, Chile.

Other stations have been established at Coolidge Field, Antigua, B.W.I.; Navy Electronics Laboratory, San Diego, Calif.; and Woomera, Australia. Naval Research Laboratory (NRL) personnel have been operating the Blossom Point facility for the past 14 months and are cooperating with the Air Force in running the Antigua installation. Officials from the Navy Electronics Laboratory are operating the San Diego unit while the Australians are manning the station "down under."

Minitracks



The rest of the units are being operated by the Army Map Service which has assigned about 14 NRL trained men and one officer for each facility. All of the stations will have one NRL scientific consultant and a commercial technical representative.

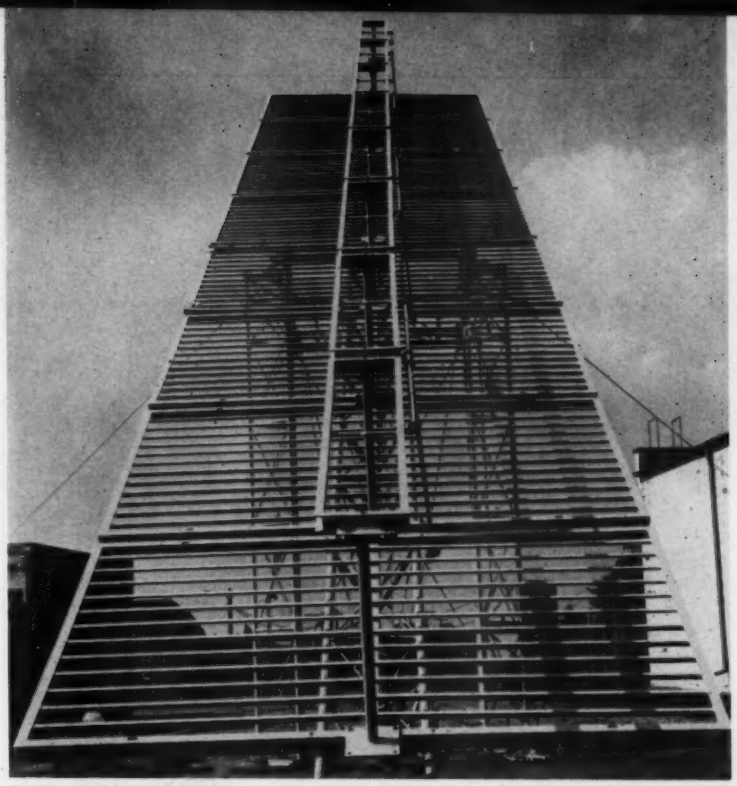
All of the stations have the same general appearance as the Blossom Point facility which served as the test and development area for all of the Navy-designed Minitrack equipment. Located in an isolated part of southern Maryland, the station has been set up in 25 acres of clear land hacked out of the surrounding dense woodlands. In the center of this area are located nine antennas, eight used for tracking the satellite and one for receiving the telemetered information.

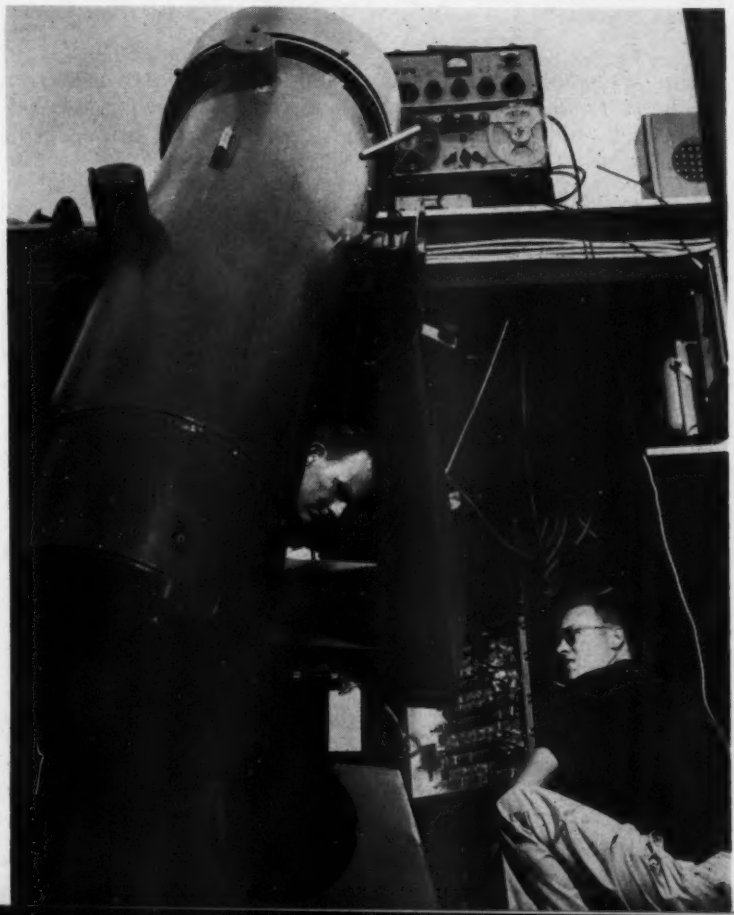
The four main antennas are arranged in the form of a giant cross with its 500-foot long legs on the north-south, east-west lines. The antenna system is directional to a certain extent, arranged so that it is most sensitive to broadcasts coming from north or south of the station. Four additional antennas are installed in the center of the Blossom Point clearing to give more precise information concerning the path of the metal moon.

In the center of this 500-foot square array of reception equipment is the Minitrack receiving trailer. Inside the trailer is the electronic equipment necessary to determine the path of the metal sphere and record the information on paper. The Minitrack signals coming from the tiny satellite transmitter are picked up in the front end of the trailer where they are mixed and amplified. They pass into a recorder where the signals are joined by the correct time, fed from an electronic clock (accurate to .0001 of a second), and the phase measurement of the signal received.

The phase measurement is the minute time difference between the signal received on the north antenna and the south installation (or east and west), by which it is possible to determine the length of each radio beam which, along with the angles of reception, will pinpoint the satellite's position.

The transmitter which broadcasts the vital beam to the earth stations is a tiny unit weighing about 13 ounces, but having a range of more than 4000 miles. It will operate on a fixed frequency of 108 megacycles





EYES AND EARS—Antenna network will keep track of and pick satellite's 'brains.' Below: Special cameras like this will record on film path of satellite.

FAST PHOTOS—Photographing an object flying about 18,000 miles per hour, calls for quite a camera. Astrographic camera can do it easily.

with a power of 10 milliwatts, which is a millionth as strong as standard radio broadcasts. The seven 1.2-volt mercury batteries powering the transmitter will have a life expectancy of about 336 hours (two weeks), but if solar batteries are perfected by the launching date the transmitter may continue to operate through the entire life span of the metal globe.

A second type of receiving equipment has been developed by the Naval Research Laboratory called Minitrack, Mark II. It will be used by volunteer tracking stations throughout the world to provide scientists with additional transit times from locations other than the 10 prime Minitrack receiving units.

Only two antennas will be used with the Mark II when it is tracking the satellite. The sensitive nature of this equipment was proven when the Blossom Point Tracking Facility received signals bounced off the moon by the giant radar transmitter Diana. Mark II was modified to receive the moon signals on 151 megacycles instead of the standard Minitrack frequency of 108 megacycles.

In addition to tracking the speeding sphere, the Minitrack facilities will also "pick the brains" of the satellite as it flashes overhead. The ninth antenna will focus on the approaching sphere and its beam will trigger a telemetering system which will broadcast the scientific data that it has gathered to a receiver-recorder below. As the satellite moves off on another 90-minute trip around the world the telemetering system will be turned off by a signal from the ground and the instruments will begin to store up scientific data to be broadcast next time around.

The Minitrack facilities will have the task of determining if the satellite achieves an orbit after it is launched from the third-stage rocket. The Antigua station will use special equipment to obtain an initial fix on the satellite immediately after it has been launched. This missile range technique of obtaining an initial fix will show if the globe is orbiting and if so, the route it will follow. Vanguard officials expect to be able to predict the first passage of the satellite with an error of no more than six minutes and to pinpoint its location within several hundred miles.

The Minitrack tracking system is so designed that it can operate with greater speed in all kinds of weather, gathering data on the satellite in orbit. However, it operates only so long as the transmitter in the sphere continues to send the vital signals.

Optical Tracking

Only through the use of the data received from the network of Minitrack stations can the 13 prime optical tracking sites scattered around the globe locate and photograph the satellite's position in orbit in relationship to known positions of the stars. Two of the 10-foot camera's will be located in the U. S.; one in the Hawaiian Islands; four in South America; three in Africa; and one each in Japan, India and Australia.

The visual tracking program, being conducted by the Smithsonian Astrophysical Observatory, will be particularly useful after the Minitrack transmitters run down.

The cameras, which have the power to photograph the satellite at a distance of 1500 miles above the earth, have a 30-degree field of view and a 20-inch aperture. A strip of 55-mm motion picture film will be exposed during the satellite passage and time will be measured to an accuracy of .001 of a second. The resulting photographs will pinpoint the exact location of the satellite at a given time against a background of stars whose movement and posi-

tions are known.

The same system of charting the path of the satellite against a background of stars will be used in the visual tracking program, Operation Moonwatch. About 150 volunteer observer teams throughout the world will patrol overlapping sections of the sky through wide-angle telescopes along the north-south line beneath a "T"-shaped pole. The time the metal moon first enters the field of view, disappears behind the crossbar on top of the pole, reappears and then disappears will be recorded and the path of the satellite will be traced onto a star map, which will be sent to the observatory.

One of the principal functions of the Moonwatch teams is to obtain independent position data on the satellite which will be of value in alerting the photographic stations. However, the observers will depend initially on Minitrack reports from the Vanguard Computing Center to locate the satellite as it appears, traverses the sky and disappears below the horizon in a very few minutes.

Computing Center

The Computing Center will begin predicting an orbit as soon as the first Minitrack measurements are reported and will continue to do so with ever-increasing precision as more data becomes available. A second computing installation at the Massachusetts Institute of Technology will work with the data obtained by the photographic stations and the Moonwatch groups. The satellite orbit predictions of both installations will be correlated.

Both computing centers will use electronic data processing systems to perform the calculations necessary to keep pace with the orbit of the satellite. During the calculations, electronic impulses speed back and forth over a complex of wires at a rate of 186,000 miles per second. They reverse direction a million times during the same interval, with the speed being harnessed by the circuits within the computer.

When the system is put into operation the Minitrack stations have already forwarded the data gathered during the last satellite pass to the Vanguard Control Center at the Naval Research Laboratory. Carried via landline, the information arrives at the Computing Center on punched paper tape and is automatically punched into cards. The cards feed the information into the computer's core memory storage unit which adds the data to the instructions already received. The results are produced on magnetic tape at the rate of 2500 words per second and later converted to printed form. Each word is a group of symbols which expresses digits or alphabetic characters in machine language.

TRANSPARENT GLOBE shows radio fence to be formed by Minitrack stations placed along the 75th meridian near Washington D. C., to tip of S. America.

In printed form the electronic device predicts the satellite's position in latitude and longitude on a minute-to-minute basis. It tells which Minitrack stations should be hearing the signals, what optical station will next see the satellite and also tells the daylight condition at that point (twilight, dawn, daylight, night, etc.) Included in the predictions is the metal moon's expected altitude.

In order to accomplish these predictions (41,600 additions or subtractions per second; 4100 multiplication or division of 10 digit numbers per second) the computer relies on high-speed "memory" devices which store both data and instructions in readiness for calculations. Magnetic tapes, and drums, and the newest system called "core memory," permit over nine million words of information to be stored in the machine. More than 147,000 tiny memory cores are available in the computer, each about the size of a pinhead and shaped like a doughnut. They are strung on a complex of wires through which the electrical pulses pass, altering the magnetic state of the tiny core. A line of these altered or unaltered cores stands for a certain word or number.

The predictions of the computer are either produced on a line printer, on a magnetic tape or on punched cards. It can also picture its output on a cathode ray tube recorder similar to a TV screen, in the form of graphs, engineering symbols, figures or words and numbers.

The predicting of the orbit to be followed by the satellite is done in a matter of seconds once the machine is fed the raw material. The satellite orbit forecasts are flashed to the control center and then relayed to the appropriate Minitrack or optical tracking station so that more data can be gathered to feed into the computer which will predict more precise orbit information about the future trips of the man-made moon.

—William Prosser, JOC, USN.

Navy in Space — How and Why

THE STARTLING ANNOUNCEMENTS of rocket and missile accomplishments in recent months have suddenly caused eyes and minds to be focused skyward and beyond into space.

What's behind all this and just how does the Navy—traditionally a sea-going outfit—find itself involved in space research?

To start at the beginning, you must go back to 1 Aug 1946. That's when Public Law 588, enacted by the 79th Congress and approved by the President, established the Office of Naval Research "to plan, foster, and encourage scientific research in connection with its paramount importance as related to the maintenance of future naval power and preservation of national security."

When established, the Office of Naval Research assumed the responsibility for supporting the peacetime research in nearly every area that had implications for the Navy. This first peacetime venture by the U. S. government into large-scale support of basic work in science helped to replenish the reservoir of fundamental knowledge that had been exhausted by years of extensive wartime development.

As the Navy's representative in the world of science, ONR had the mission to make available whatever science has to offer which might result in modern weapons, devices, and techniques, so that now and in the foreseeable future the U. S. Navy will be superior to any in the world.

To do this, ONR must know what is going on in science that will help the needs of the Fleet. It must know the latest theories concerning the physical forces acting on a moving body underwater, such as a submarine; about cosmic ray activity and very high-altitude weather conditions for high-speed, high-altitude flight; the areas scientists are exploring in order to become aware of new findings that might hold some promise for use to the Navy.

On the other hand, ONR must do much of this research itself or see to it that some other activity does it. A good example is the broad, continuous program of upper atmosphere research which the Office of Naval Research launched as one of its first endeavors back in 1946. Initial plans in this highly specialized field of research called for the establishment of a stable platform for high-altitude observation of atmospheric physics, nuclear energy and cosmic radiation.

THE BASIC PROBLEM was to develop a vehicle capable of carrying the necessary instruments to sufficient altitudes and remaining there long enough to make the desired observations. Previous vehicles, including aircraft, rockets and rubber balloons possessed inherent limitations for extended observations in the stratosphere. Remember, this was 11 years ago.

Rocket Test—1947

A man-made satellite appeared to be the only solution to this space platform. The idea of using satellites back in 1946 was neither a new idea nor a "dream," even at that time. Much had been written about them and the feasibility of satellites had been proven as early as the 16th century through Johann Kepler's laws of planetary motion.

Although satellites appeared to be the only logical platform for conducting high-altitude research, a means of getting them into space had not as yet been developed.

Meanwhile, the Navy's upper atmospheric research program was continuing through the development of new research tools and by making the best use of what was available.

The Office of Naval Research developed high-altitude plastic balloons to carry instruments and eventually human observers high into the stratosphere. At the same time, (Dec 1946) the Naval Research Laboratory began work with research rockets, using at first the German *V-2* made available by the Army, and then Navy-developed rockets such as the *Viking*, *Aerobee* and *Aerobee-Hi*.

One of the Navy's *Viking* rockets carried a camera to 158 miles, the greatest height from which photographs of the earth have been taken. *Aerobee Hi* rockets, also developed for the Navy, have gone as high as 180 miles, a record for a research rocket.

Until early 1954 all *Viking* rockets were devoted to upper atmosphere research. At that time, however, two *Viking* rockets were fired (in May 1954) with equipment to investigate the limits of precise tracking for guidance and re-entry experiments. Both of these test flights proved highly successful.

By this time, technological advances in power plants and in aerodynamics had progressed to the stage where the possibility of manned aircraft and other types of vehicles flying beyond the atmosphere was becoming closer to a reality.

REALIZING THAT A DEFINITE need for a space platform existed, Navy scientists, in June 1954, decided that something other than just another study should be done about launching an earth satellite.

Shortly after this decision was made, a meeting was held at the Office of Naval Research in Washington, D. C., (on 25 Jun 1954) to determine the best way to set up a research program using satellites as a research tool.

Army and Navy scientists attended this initial conference and decided that by using existing rocketry—an Army *Redstone* missile as the main booster, on which would be mounted a multiple cluster of *Loki* rockets—that it would be possible to launch a satellite within the next two years, if such a project was undertaken as a joint Army-Navy effort.

After lengthy discussions as to the size of the satellite and the types of information which a satellite could collect, it was agreed that enough information could be obtained from a minimum-weight satellite to war-

rant going ahead with this type of project as the first step in an eventual large, all-out satellite program.

Army and Navy scientists agreed at that time that even a five-pound satellite would teach the launching techniques and tracking methods, and could be done within a much shorter time than would be required for a fully instrumented satellite.

It was further agreed that there were many possible methods and many rocket combinations which could be used to place the satellite in an orbit, but that the *Redstone-Loki* combination was at that time capable of putting a satellite in an orbit without new major developments.

The conference came to these conclusions:

- A satellite could be placed in an orbit by using the *Redstone-Loki* combination.
- Such a program was justifiable from a scientific standpoint.
- A satellite program should be established.
- Such a program had to be organized as a team effort.

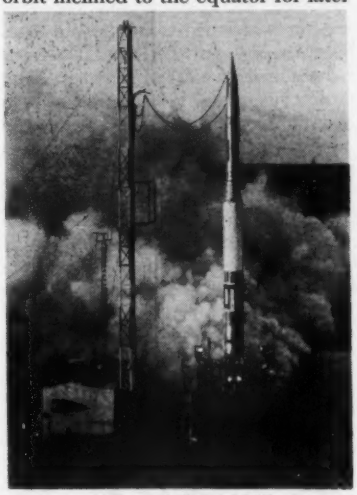
WHEN THE ARMY notified the Navy of its willingness to take part in a satellite program, the Chief of Naval Research authorized the Air Branch of ONR to go ahead and conduct the preliminary studies necessary to establish this program. Working closely with the Army, this initial satellite project was outlined and the divisions of responsibility were planned.

It was agreed that the Navy would handle the design, development and construction of the satellite, arrange for the tracking facilities, the coverage of logistic support, and record the tracking data. The Army would be responsible for the over-all missile design and the construction and launching of the satellite's launching vehicle. With these agreements firmed up, the joint Army-Navy satellite project was given the name "Orbiter."

The Army and Navy went ahead with these plans and in January 1955 invited the Air Force to join them. In the meantime, three contracts were let. The first, was for a study to determine the requirements for making the satellite visible by optical and electronic means. The second was for the design and development of the guidance system to place the satellite into its orbit, and the last was a study to cover the development of the *Loki* cluster.

The problem of logistic support became quite evident in Orbiter's early stages. Men and equipment would have to be shipped to all parts of the world. A launching site and tracking station would have to be built. And then supplies for the operating crews of the launching and tracking facilities had to be available. When approached on this matter, a representative of the Chief of Naval Operations said, "Tell us what you want moved and where to and we'll see that it gets there." That settled the so-called logistic problem.

On 23-24 May 1955, it was decided that a minimum-weight satellite could be established with known equipment. An equatorial orbit was considered best for the first satellite, to facilitate tracking and recording; and then either a polar orbit or an orbit inclined to the equator for later



Vanguard Test—1957

vehicles. At this time, the Naval Research Laboratory made available its Minitrack system, as a possible electronics tracking mechanism.

WHILE THE ARMY AND NAVY were going ahead with their plans to launch a satellite, groups of civilian scientists were also working on similar plans. The U.S. National Committee for the International Geophysical Year had requested the National Science Foundation and the Department of Defense to support an earth satellite program as part of the U.S. effort for the IGY.

This proposal was accepted in July 1955 and Project Orbiter was cancelled since the basic information which it sought could be received through the IGY satellite program.

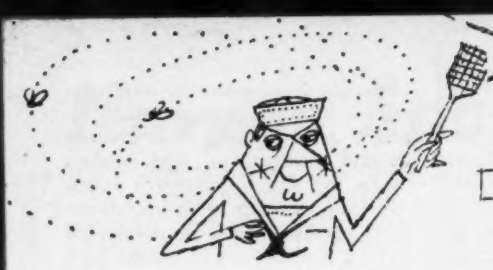
Even while plans for Orbiter were underway Navy scientists were continuing to conduct high-altitude research with balloons and rockets. Several months ago, NRL rockets made the first quantitative intensity measurements of micrometeors, those particles which are considered to be a possible serious hazard both to earth satellites and to the flight of long-range missiles through the upper atmosphere.

This work by the Naval Research Laboratory not only required a proficiency in rocketry but in rocket instrumentation, particularly in the art of telemetering the information back to earth. Sending information from rockets high in the stratosphere to the ground via radio became a fine art at NRL. This experience resulted in the Navy, specifically NRL, being assigned the responsibility of designing and launching the American earth satellite as part of Project Vanguard.

FROM THE VERY BEGINNING Project Vanguard . . . the Department of Defense phase of the U.S. earth satellite program . . . has been purely a scientific program. Although it is possible that a military missile already under development might have been able to launch a satellite before the scientific research rocket developed for Project Vanguard there were good reasons for planning it as a pure research project completely divorced from our military missile effort. It made it possible for virtually the entire earth satellite program in this country to be unclassified. This means that information about it is freely available to scientists throughout the world.

The advancement of scientific knowledge learned through basic research and the wide dissemination of this increased knowledge have been basic policy of the Office of Naval Research since its establishment and, as a result, the major portion of the Navy's basic research program is unclassified.

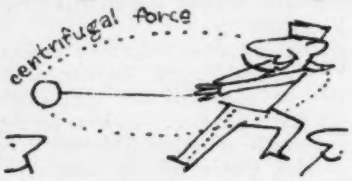
In this same vein, you will notice that throughout the past 11 years of rocket development and high-altitude flights, the prime interest of the Navy, in particular the ONR-NRL team, has been basic scientific research—finding out more and more about the envelope of atmosphere that surrounds the earth. And that is precisely the announced objective of the upper-atmosphere program of the International Geophysical Year, and the reason for Project Vanguard.



Vocabulary of S

HERE'S A GLOSSARY of some of the scientific phrases and terms that you'll come across in reading the articles in this issue about the Navy's role in support of the International Geophysical Year.

• ***Airglow.*** The glow or light, other than that from the stars and the moon, which you see at night. The sun's radiation causes the atoms and molecules of the oxygen, nitrogen, sodium, hydrogen and other gases in the earth's atmosphere to act as miniature powerhouses and store up the energy of the absorbed sunlight.



At night, this stored up energy becomes visible. Although it is five times as bright as that given off by all the stars you see in the sky, much of the light created by airglow is invisible.

• ***Astrophysics.**** The application of the laws and principles of physics in relationship to the constitution of the celestial bodies. It applies to almost every phase of astronomy.

• ***Atmosphere.*** The air or gaseous body that surrounds the earth or any celestial body. In the case of the earth, it includes the air we breathe and the entire gaseous envelope that presses at all points upon the earth's surface, as well as that which extends all the way out into space. This ocean of air is estimated to weigh more than 5,000,000,000,000,000 (five million billion) tons.

• ***Atom.*** A particle of matter consisting of electrons (negatively charged particles) surrounding a nucleus made up of neutrons and protons (positively charged particles). The number of electrons surrounding the nucleus is equal to the number of protons in the nucleus so that the atom itself has no net electrical charge.

• ***Auroras.*** Commonly referred to as Northern and Southern Lights, they are colorful glows or light effects that occur in the atmosphere when streams of electrically charged particles from the sun strike the upper air. They are usually seen mainly in polar or high latitudes because the charged particles are attracted by the earth's magnetic poles. Auroral displays, seen only at night, look like streamers of light, somewhat like distant heat lightning or masses of multi-colored flashing lights.

• ***Celestial.*** Refers to the sky or visible heavens. Thus, a celestial body is a star, planet, comet or other matter which exists in the universe.

• ***Centrifugal Force.*** The force which makes an object revolving around an axis (for example, a weight being whirled around at the end of a string) want to move directly away from the axis.

• ***Cosmic Rays.*** Extremely high energy particles, traveling at almost the speed of light, which are bombarding the earth from space. These particles are mostly hydrogen nuclei (protons), but nuclei of other elements are also present.

• ***Cosmology.*** The general science of the universe. It covers all of the parts, laws and functions of the universe that are already known and

those that can be obtained through observation and research.

• ***Earth Satellite.*** The moon is the earth's only known natural satellite. It circles the earth on a fixed path or orbit about once every 28 days. An artificial earth satellite is a man-made sphere launched into space so it circles the earth in somewhat the same manner as the moon does.

• ***Ellipse.*** The curve formed by slicing through a cone. The shape of this curve may vary from being an almost perfect circle to a long, narrow shape similar to a rubber band.

• ***Elliptical Orbit.*** The ellipse-shaped path followed by a heavenly body as it moves about the center of the system to which it belongs. The earth, its moon and the planets all have elliptical orbits.

• ***Exosphere.*** The outermost portion of the atmosphere where the atmospheric particles are so few that they very rarely collide with one another. Its lower boundary is about 600 miles from the earth.

• ***Geodesy.*** The science of determining the size and shape of the earth. Since the variation of gravity over the earth's surface is important for determining the earth's shape and in determining positions accurately, gravity studies and surveys are often included under this science.

• ***Geomagnetism.*** The study of the earth's magnetic field. It is also called terrestrial magnetism.

• ***Geophysics.*** *Physics* is a comprehensive name for the branches of science which deal with those natural phenomena which are not biological and not merely descriptive. *Geophysics* is the name for those parts of physics which are concerned with the solid earth, the oceans and the atmosphere. Seismology, geomagnetism, geodesy, meteorology, atmospheric physics, glaciology, hydrology and oceanography are subdivisions of geophysics.

• ***Gravity.*** The force of mutual attraction between material bodies. Sir Isaac Newton found that this force varied directly with product of the masses concerned and inversely as the square of the distance between them. It is this attraction which draws objects (such as Newton's apple) toward the center of the earth and gives them the property of weight.

• ***International Geophysical Year (IGY).*** An 18-month-long study of this world and the natural forces from within and without which af-

fect it. Studies by scientists of 64 nations began 30 Jun 1957 and will continue through 31 Dec 1958.

• ***Ion.*** An atom (or, in some cases, a group of atoms) which has an electric charge because the number of electrons surrounding the nucleus does not equal the number of protons in the nucleus.

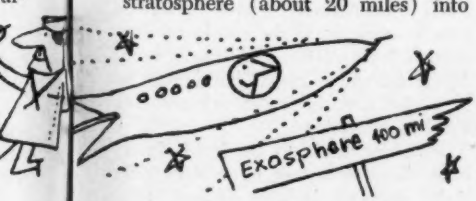
• ***Ionization.*** The formation of ions. Among the ways ions may be formed is the knocking of electrons out of a neutral atom during a collision with another particle.

• ***Ionosphere.*** A layer of air in the upper atmosphere extending from roughly 40 miles to an altitude of about 400 miles, consisting of several layers of ionized gases known as the D, E, F, and G layers. These layers bend radio waves back to earth where they originate, making possible long-distance communications.

• ***Liquid Oxygen.*** This gas is compressed until it becomes a liquid which will support combustion in a rocket engine in the near vacuum of space. In its compressed state it has a temperature of —297 degrees F.

• ***Magnetism.*** Magnetism is demonstrated by the attractive force that exists between a natural magnet (lodestone) and a piece of soft iron. This attraction exists even when they are not in contact, and this action-at-a-distance is said to be due to the magnetic field or field of force around a magnet. Hans Christian Oersted found that an electric current has a similar field of force which affected that of a magnet (1820). About 1825 Andre Marie Ampere concluded that a magnet is due primarily to electric current circulating within the molecule, which is the view still held today.

• ***Mesosphere.*** The middle atmosphere extending from the top of the stratosphere (about 20 miles) into the ionosphere.



• ***Meteor.*** A celestial body that enters the earth's atmosphere at great speed and begins to burn owing to the friction of the atmosphere, making it visible from the earth. It is popularly known as a shooting star.

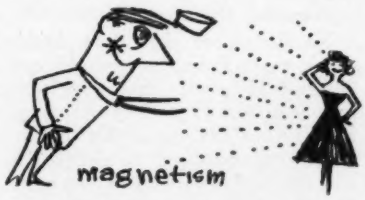
• ***Meteorite.*** A meteor that strikes the earth.

• ***Meteoroid.*** The celestial particle which becomes a meteor upon entering the earth's atmosphere. Some particles are invisible to the naked eye and weigh about one hundred-millionth of an ounce (micrometeors) while others may weigh millions of tons. The meteorite that struck in Arizona is estimated to have weighed more than 10 million tons.

• ***Meteorology.*** The study of the atmosphere and its activities, especially those that affect the earth (wind, rain, clouds, storms, etc.).

• ***Minitrack.*** A radio tracking system used to record position signals from a vehicle in flight from which high frequency radio waves are being transmitted. The signals are received by special ground stations.

• ***Moon.*** This is our nearest space neighbor and will more than likely



be the first target of space voyagers. Its mean or average distance from the earth is 238,840 miles and it travels once around the earth every 27.32 days.

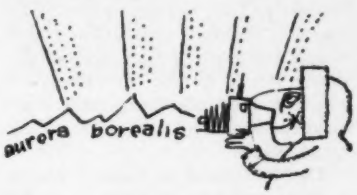
• ***Oceanography.*** The study of the ocean, its currents, composition, etc.

• ***Orbit.*** The path a celestial body follows as it circles the center of its system (for example, the earth's path as it circles the sun).

• ***Ozonosphere.*** Located in the upper reaches of the stratosphere, this layer of the atmosphere is characterized by the concentration of ozone gas found there. The ozonosphere acts as a shield for the earth, filtering out the major portion of the invisible ultraviolet rays which would destroy all life if the total amount entering the ozonosphere reached the earth.

• ***Project Vanguard.*** The Department of Defense portion of the U.S. Earth Satellite Program. A tri-service project under Navy management, Project Vanguard includes development of the satellite, the launching vehicle, launching facilities, the radio tracking of the satellite and the recording of data from the satellite.

• ***Rocket.*** A thrust-producing sys-



tem or a complete vehicle which derives its jet-like thrust from ejection of hot gases generated from material carried in the system, not requiring intake of air or water.

• ***Satellite.*** An attendant body that revolves around a larger one, such as the earth's moon. Natural satellites are usually classed as secondary planets in the solar system.

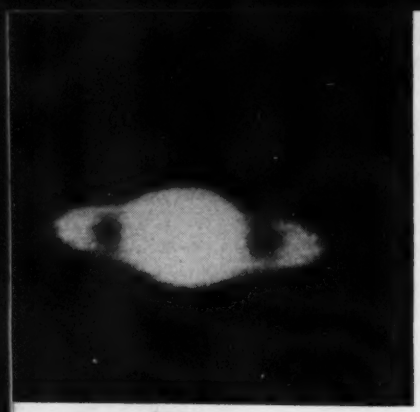
• ***Solar.*** Pertaining to the sun; that is, sun heat; solar heat.

• ***Solar System.*** Our sun and the group of celestial bodies including the earth, which revolve around it. The system consists of celestial bodies including the sun, nine planets, 28 satellites and more than 1500 minor planets or asteroids.

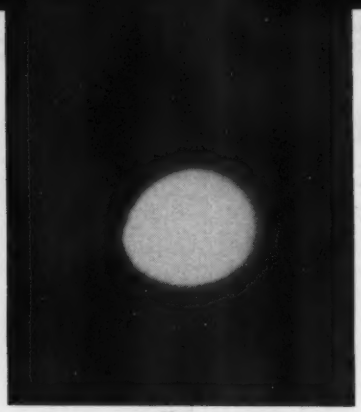
• ***Stratosphere.*** A portion of the atmosphere beginning above the troposphere (eight miles) and extending to an altitude of about 20 or more miles.

• ***Ultraviolet Rays.*** Light rays whose frequency is higher than the frequency of light rays visible to the eye.

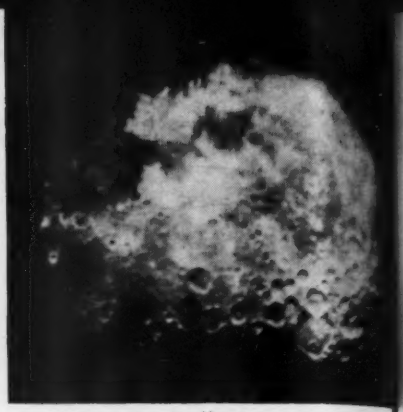
• ***Universe.*** The entire celestial cosmos including our solar system, other systems, stars, meteors and all other celestial bodies.



Saturn



Mars



Moon

What's It Like Up There?

IN HIS EFFORTS to gain knowledge about the earth's atmosphere, man has learned that the ocean of air surrounding this planet is several hundred miles thick with no pronounced boundary. The atmosphere is divided into four different layers: The *troposphere* where we live; the *stratosphere* where we fly; the *ionosphere* which we are now exploring with rockets; and the *exosphere* where space begins.

The air found in these layers is a mixture of 21 parts of oxygen and 78 parts of nitrogen. The remaining one part is composed mostly of argon, with traces of neon, helium, krypton, xenon, ozone, hydrogen, carbon dioxide and water vapor. This mixture of gases exerts a pressure of 14.7 pounds per square inch of earth surface at sea level, but as you go higher its density thins.

It has been estimated that if all the air surrounding the earth were compressed to the density of that at sea level it would be only five miles thick. Mount Everest (and several other peaks) would project into space and a man would be able to launch a satellite simply by climbing to the top of one of these peaks and throwing it. However, in real life it doesn't work this way.

The troposphere extends upwards some eight to 10 miles. It is the area where most clouds form and where storms rage. As we climb higher the temperature drops to a low of 70 degrees below zero and if in a balloon, we would be knocked about by winds exceeding 80 mph. The barometer would drop as we rose higher, but the chemical makeup of the air would remain the same.

If you were to make this ascent without auxiliary oxygen you would have been uncomfortable at two miles, breathing hard at three miles, unconscious at four, and dead long before you reached the next layer called the stratosphere.

The stratosphere, home of jet airplane pilots and the high-altitude balloon scientist, extends from the troposphere to an altitude of about 60 miles. Inside these boundaries we find the last clouds, and the air around us begins to warm after 20 miles until it reaches a temperature of 170 degrees only to fall again to many degrees below freezing. Here the winds may rise to several hundred miles per hour to tear at research vehicles. Wispy clouds of dust carried up from the lower level of air may dance 50 miles above the earth. In this layer we find one of the most important parts of our atmosphere, the *ozone* layer.

Nearly all of the atmosphere's ozone gas is found between 15 and 30 miles above the earth in a layer that, unknown to the majority of us, protects our very lives. The nature of this gas enables it to absorb the majority of the sun's ultraviolet rays, thus saving the human race from the granddaddy of all sunburns. If these

There's A Lot We Need To Know About This Ocean of Air Around Us

rays penetrated to earth it would mean certain death for mankind, but conversely if the ozone layer became too thick and shut off all the ultraviolet light the earth would soon lose its supply of Vitamin D. But again the nature of this gas protects us, for it is dependent on the ultraviolet light which creates it—more rays, more gas—less rays, less gas—maintaining a perfect balance.

The ionosphere—Artificial satellites and the rockets for research are launched into this next layer. The ionosphere extends from 40 to 400 miles above sea level. Scientists have succeeded in exploring this area only with high-altitude rockets and high-frequency radio beams. In this electrified layer the sun's radiation has broken down the molecules of air, producing electrically charged ions which form into layers. These ions reflect radio signals back to earth, making possible long-distance communications. But these same layers allow the very short radar wave lengths to pass into space to bounce signals off the moon.

The full effect of solar flares and sunspots are in this electrified layer. When these occur, the sun is giving off tremendous amounts of electrical energy which cause disturbances in the ionosphere, disrupting radio communication for hours or even days. The various ion layers, each of which affects a different type of radio communication, are constantly swaying and shimmering. The band closest to the earth is the D-layer which reflects the long radio waves used for standard broadcast, but allows the short radio waves to penetrate to the E-band which reflects radio transmissions of shorter wavelength such as those employed for police broadcasts. The uppermost layers are the F and G bands which serve as the reflecting mirrors for shortwave stations.

In order to keep track of these ever changing layers, more than 150 radio stations located around the

world gather data on the fluctuations and variation of the ion-layers. This information is used to prepare elaborate charts which in essence tell radio stations the best frequencies to use and the results that can be expected by transmitting at various times of the day.

Shooting stars appear in the lower reaches of the ionosphere as the falling meteorites ram into the thicker atmosphere and burn, but near the top of this layer you are virtually in space. Wind velocity climbs to 300 mph and the temperature may be as high as 4000 degrees, far higher than the temperature of liquid iron. But it is heat without heat, for the temperature is contained in the individual molecules of air speeding about in the near vacuum of space. A rocket passing through this area would not be affected by this heat because there are few molecules to pass the heat to the surface of the vehicle. The rocket might even lose heat in this area, radiating some of its body warmth into space.

The exosphere lies beyond the ionosphere. Scientists detect gas in this region above 500 miles, but in such small amounts that it no longer matters and even that fades out in space. To set a limit one might say that space begins between 400 and 1000 miles above the earth and continues on and on, farther than our biggest telescope can see, or to a point where radio signals disappear into oblivion, to infinity.

From this dark void the earth's atmosphere is constantly being bombarded with invisible rays of unknown origin. Cosmic rays with particles ranging in size from the elusive electrons to the nuclei of heavy atoms, crash into the atmosphere at speeds approaching that of light, 186,000 miles per second. The debris of their impact showers down on earth. Others hurl a constant stream of electromagnetic radiation at the roof of the world and joining in the bombardment are visible light rays, invisible ultraviolet and infrared radiations, corpuscular streams from the sun and radio waves.

Also pouring into the ocean of air surrounding earth is an assortment of materials that could be termed space trash. Some of this assortment of metal and rock arrives at a speed of 10 miles per second; others may have a velocity six or more times greater. These meteors come in many sizes, but the majority are invisible to the eye. These are called micrometeors and it has been said that 750 billion of these particles each weighing about one hundred-millionth of an ounce reach the atmosphere every 24 hours. Their origin is also a mystery. It is known only that they come from "out there."

"Out there" are the stars we see at night and the sun around which our nine planets rotate; but the most pronounced heavenly body (with the exception of the sun), is our moon. This lifeless body whirls around us as we travel around the sun. The moon never shows more than one face to the earth as it travels in its orbit a mean distance of 239,000 miles away.

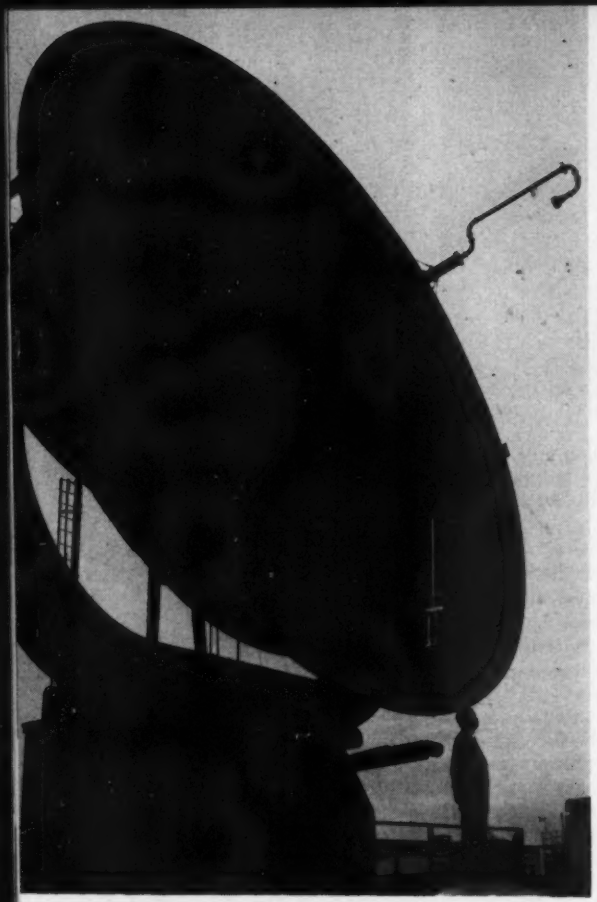
In theory, man needs only to develop a rocket that can equal or exceed the speed necessary to free it from the earth's gravitational pull to travel to the moon. This speed of escape is slightly more than 25,000 mph, only 7000 more than that expected of Vanguard which will launch the earth satellite.

The other occupants of our part of the universe are Mercury, Venus, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto. The planet nearest the sun is Mercury which is only 36 million miles from the solar body. The earth is third at a distance of 93 million miles while the last known planet in this universe is Pluto which has an average orbit distance from the sun of 3675 million miles. If you attempted to fly to Pluto in a rocket traveling 25,000 mph it would take you 6125 days or almost 17 years.

That's a long tour of SPACE DUTY.—William Prosser, JOC, USN.

NAVY ROCKETS such as *Viking* have carried instruments high into the sky to record what goes on up there.

SKYHOOK BALLOONS have been used to launch *Deacon* rockets from high up to bring back the secrets of the earth's atmosphere from new heights.



Highlights on Vanguard

Not long ago, Dr. John P. Hagen, director of Project Vanguard, U. S. Naval Research Laboratory, delivered before the National Press Club of Washington, D. C., a report on America's satellite program. He explained the background of Project Vanguard, told how Vanguard worked, what had been accomplished, and what was anticipated for the future. Here are some of the highlights of that report.

A COMMITTEE OF SCIENTISTS and engineers appointed by the Defense Department to study the problems of launching a satellite into an orbit and to consider the handful of proposals from the Army, Navy and Air Force for doing this, selected the proposal of the Navy, and for this approach, coined the name VANGUARD.

The Navy proposal was to use rockets developed for use in the earlier upper air research program. These rockets needed modification to make them suitable for the satellite-launching job, but were rockets of demonstrated capability. The first-stage rocket was based on the Navy *Viking* research rocket, the second stage stemmed from the *Aerobee*, the third stage, however, was a newly designed solid-propellant rocket.

The planned program for Project Vanguard called for the launching of a scientific satellite in an orbit around the earth during the course of the International Geophysical Year. The satellite launching attempts were to be preceded by a test-launching program in which the various stages of the vehicle would be flight tested. This test program culminates in a three-stage test vehicle which differs from the launching vehicle only in detail. This type of program was necessary since the rocketry employed in Vanguard is separate and distinct from our ballistic missile rocketry and therefore had to be developed and tested within the program.

AFTER AN EARLY SUCCESSFUL flight test of the third-stage rocket, a change was made in our test program to make the payload in the three-stage test vehicle a six-inch sphere equipped with radio transmitters. If any one of these test vehicles goes through all its tests in a completely satisfactory manner, the six-inch sphere can go into an orbit.

Earth satellites can be best used to do three kinds of experiments:

- One can ask the satellite what is going on in its vicinity. To do this, sensing units are placed in the satellite to measure such things as temperature, pressure, meteor impact.
- The orbit is carefully observed and from the changes in the orbit, occasioned by the drag of the residual atmosphere and by the attraction of the equatorial bulge on the earth, the density of the upper atmsophere and certain deductions concerning the shape and the size of the earth can be made.
- Scientific apparatus is installed in the satellite and uses the satellite as a space platform. This apparatus is designed to measure and observe astronomical things, such as radiation in the ultraviolet range from the sun. The apparatus might be designed also to measure meteorological things in the atmosphere, such as the extent of cloud cover around the equatorial belt of the earth from which can be deduced the energy balance of the atmosphere, and fundamental knowledge concerning the make-up of the world's weather can be derived.

Another type of experiment is one in which the primary cosmic rays are observed and analyzed. A fourth kind of experiment is one in which the magnetic field of the earth and electric currents found in the ionosphere are measured.

ALL OF THESE EXPERIMENTS are ideally suited to a satellite in that they involve measuring things outside of the absorbing atmosphere of the earth—things that cannot be measured here on the surface of the earth—the measurement of which will expand our knowledge of the universe in which we live.

The program for constructing and instrumenting the satellites progressed well. The experiments were chosen by the committee of the National Academy of Sciences and prepared in various laboratories. The satellites were designed and assembled at Naval Research Lab.

The first of the satellites—designed to measure the ultraviolet radiation from the sun and to make environmental measurements of our outer atmosphere—has been completed and has gone through a series of rigorous tests to insure its satisfactory operation. These tests have culminated in one where the satellite, fully operating, has been held in a vacuum under controlled

temperature condition for 15 days and has continued to operate well. This is ready for flight. The second version is nearly completed, with the third and fourth following in good order.

The six-inch sphere for use with the test vehicles has been completed and is ready for installation. This package contains two tracking transmitters, one of which operates from solar cells. The transmitters are so arranged that environmental measurements such as temperature can be made and reported back.

RADIO TRACKING of satellites is done at 108 mc. To effect this an array of tracking stations has been set up extending from Washington, D. C., to Santiago, Chile. This array is designated to intercept satellite passage each time round and to measure its position accurately. There are additional stations at Antigua, BWI, for aid in launching and early detection, in San Diego, Calif., and in Australia.

Associated with the tracking system is a computing center equipped with high speed computers to make possible the rapid calculation of the orbits and the accurate prediction of the future courses of the satellites. The tracking and computation system is now in operation with all stations on the air.

A satellite can be seen visually only at twilight when it is in full sunlight, and you are just beginning to enter darkness. Earlier during the daytime a satellite cannot be seen because it is a dim object, and it is not visible against the scattered sunlight in the daylight sky. At night, when the sky is clear and stars can be seen, a satellite is not visible because it too is in darkness and therefore cannot shine in reflected sunlight.

THERE IS ONE OTHER WAY a satellite might be tracked and that is by radar. Once the radar experts know with certainty in which direction to point their antennas, they will detect the satellite and measure its distance from the radar installation.

It is of great importance for us to get an early and a good measure of the orbit of any satellite appearing in the sky. It is of importante to all of us to have information concerning the atmospheric density; the geodetic information concerning the shape of the earth is available to anyone who is capable of measuring the orbit with accuracy and then interpreting the results.

DR. JOHN P. HAGEN holds a scale model of the Vanguard. A replica of the satellite is in the foreground.

Underwater Satellite

Vanguard has been primarily designed for scientific purposes—to enable the whole world to learn more about outer space. However, RADM H. G. Rickover, USN, Assistant Chief for Nuclear Propulsion, Bureau of Ships, has suggested another type of "satellite"—the underwater satellite. Here are excerpts from an address he made before an American Legion committee in Atlantic City, N. J., recently.

TODAY OUR NAVY is in the midst of change—conversion from oil to nuclear power. This change is taking place so rapidly that it is, in truth, a revolution.

Let me give you a brief timetable. The idea of an atomic submarine was conceived in 1949. Four and one-half years later the land-based prototype of the propulsion plant for this submarine was operating, and a few months later *Nautilus* was at sea.

Seawolf, the second nuclear submarine, was launched in 1955; the third one, *Skate,* last spring; the fourth one, *Swordfish,* was launched in August; and the fifth, *Sargo,* [was launched recently.] Altogether, 14 additional nuclear submarines are now under construction or authorized. Further, we are designing or constructing nuclear power plants for a guided missile cruiser, an aircraft carrier, and a frigate.

By the mid-1960s we should have in being the first nuclear task force—complete from submarines to carriers. Thus, a technological and military revolution, which in the past would have taken the better part of a century, will be completed in a decade.

WHAT NUCLEAR POWER can do for the submarine has already been demonstrated. For the surface ship it will provide virtually unlimited cruising radius. Our aim is to design nuclear propulsion plants which can last for an entire war without being refueled. The nuclear task force will not have to return to shore bases

CREW MEMBERS at diving stations on board *USS Nautilus* (SSN 571), the world's first nuclear-powered sub.

SATELLITE UNDERWATER—*USS Nautilus* represents prototype of what RADM Rickover calls 'ideal mobile platform.'

for more oil, or require an endless chain of tankers. All the replacement fuel needed for the nuclear-powered Navy of the future can be stored in a few large buildings. It is not radioactive and does not deteriorate.

In surface ships, nuclear power multiplies the distance an aircraft carrier can travel at full speed without refueling about 20 times, and the distance a frigate can travel at full speed without refueling about 50 times.

WE ARE ALSO DESIGNING a nuclear power plant for another type of ship which will be very important for antisubmarine warfare, a frigate. We hope to be able to start construction of this frigate in the near future. It will be needed to protect our naval task forces against submarine attack.

The nuclear task force will be unlike its closely knit counterpart of World War II. In order to reduce vulnerability to hydrogen-bomb attack, the nuclear task force will be dispersed over an area as big as the State of New York. No ship will be within H-bomb radius of another.

* * *

THE NUCLEAR-POWERED task force built around the atomic carrier will give the Navy unprecedented mobility and striking power.

The other two services have been developing land-based 1500-mile ballistic missiles. These will be able to travel at high speeds, making effective interception difficult.

The nuclear-propelled submarine capable of launching intermediate-range ballistic missiles with nuclear warheads could make our Navy an even more effective deterrent force.

There is no reason why intermediate-range ballistic missiles cannot be launched from floating platforms, surfaced or submerged. The Navy is, in fact, now developing such a missile, the *Polaris*.

Armed with this missile, the nuclear-powered submarine will become an underwater satellite. It will be large enough to store, maintain, and fire intermediate-range ballistic missiles, and it will be able to move anywhere at any time, completely submerged.

These underwater satellites will launch their attack from far out in the Atlantic, the Pacific, or the Arctic Ocean. They could be placed anywhere within 1500 miles of their targets. *They could be dispersed over literally millions of square miles of ocean.*

The problem of locating and destroying such an underseas Fleet will be tremendous. Search radar will be helpless against it. The enemy would be in the position of a man trying to find a black cat on a vast and empty plain on a moonless and starless night.

The underwater satellite marks the closest approach now foreseeable to the ideal mobile platform. It could go anywhere at any time. It could remain well hidden from the enemy. It would draw the enemy's missiles and bombs away from our cities and factories and farms, and draw them toward the uninhabited seas.

THE MERE EXISTENCE of this underseas Fleet would create a tremendous military and economic problem for a potential aggressor. He might calculate that so many of his missiles launched in a surprise attack could destroy our land-based counterforce before we could effectively retaliate.

But he could not make a rational calculation for an attack against our hidden and mobile underwater satellites. Many enemy missiles might be needed to destroy just one of these submerged launching platforms.

I should make it plain that this weapon cannot be built by the day after tomorrow. It will be a scientific and engineering challenge, comparable in difficulty and magnitude to the first nuclear submarine.

In other words, *Nautilus* did not mark the end of a technological road. It marked the beginning. It should be compared with the first airplane that flew at Kitty. Hawk.

For every problem we have solved in the short history of nuclear power, a hundred remain to be solved.

LIKE CLOCKWORK—Instruments like this one gather and broadcast scientific data while traveling in satellite.

Research Report

As Chief of Naval Research, RADM Rawson Bennett, USN, is well qualified to speak of the work the Navy has done, is doing, and plans to do in the fields of research which may ultimately affect the lives, not only of every Navyman, but of every citizen of the United States. This is what he had to say to members of the National Security Industrial Association at Washington, D. C.

ONLY A FEW DECADES AGO the world of science was one almost completely incomprehensible to the general public. It is true that there was some talk about ships that might some day sail around the world on a cupful of nuclear fuel or about rocket flights into space, but such achievements seemed too far in the dim future to merit serious interest.

Contrast that picture with the situation today when the advances of science are on everybody's lips. The press, the magazines, and television are constantly keeping an avidly interested public up-to-date on the latest exploits of science. Our dazzling array of new military weapons designed for the future have taken hold of man's imagination. He is quite familiar, for example, with the Navy's revolutionary submarine, *Nautilus*, our top performance interceptor the F8U *Crusader*, and such missiles as *Terrier*. A high school boy could give you a detailed run-down on the earth satellite project that would make your head spin.

I must admit that underlying this enthusiastic interest in our future is some trepidation that a nuclear war might blast it all away. On the other hand, it is the series of successful break-throughs by the scientist and his partner, the engineer, coupled with the mighty production capability of industry that has provided us with weapons we believe can forestall or prevent such a dire eventuality.

This constant focus on the future is new to us. It has been brought about by the rapid rise of the new field of research and development, which in little more than a decade has come to play a major role in our economy.

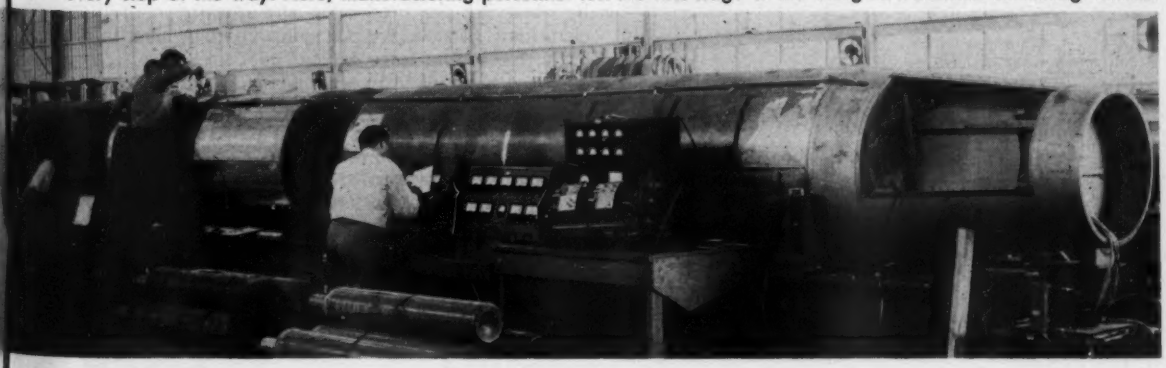
Without question, it has been basic research that in the brief span of years since the end of World War II has made possible the new Navy we are now building—a Navy utilizing fantastic forces that a decade ago we barely knew existed.

VERTICAL INSPECTION—Two engineers give Vanguard rocket a thorough going-over as it stands in its test tower.

Three-Dimensional Service

The sole object of all naval research is to insure that our Navy is, and will continue to be, the most powerful and advanced Navy in the world. The Navy is the only three-dimensional service, involving operations not only on the sea but in the depths beneath, the air above, and the land bordering the sea. This means that the Navy must concern itself with virtually every scientific development in every environment through all the domains of

HORIZONTAL TEST—Before a research project ever sees the light of day, hundreds of tests have to be performed every step of the way. Here, manufacturing personnel test the first stage of the Vanguard satellite launching vehicle.



TEST OF experimental satellite solar batteries is carried out by scientists during the final stages.

science between the poles of the earth and out into outer space. It is only logical that the Navy's basic research program administered by the Office of Naval Research runs the entire gamut of the scientific field from astronomy to zoology.

Contributions to the Future

Navy research, as it digs for knowledge that will provide us with more efficient and advanced military weapons and equipment, frequently benefits all of science and makes a major contribution to mankind's future.

Information gained from Navy-sponsored studies of celestial bodies and other phenomena in space has immediate application to such areas as *communications, navigation, high-altitude flight,* and *weather forecasting,* which have application both to military technology and civilian life.

Going beyond these mundane applications, recent work in this field has resulted in what may be a significant breakthrough in extending our knowledge of the systems of nebulae outside our own galaxy. For example, it has become apparent that a close relationship exists between the forms and constitution of the great majority of galaxies. The result of further investigation may well influence the theory of the *origin of the universe.*

Radio Astronomy

The Navy has been a pioneer in the new field of *radio astronomy* based on the discovery that planets and stars send out radio signals as well as light waves. Since 1946, radio astronomers at the Naval Research Laboratory, using the huge 50-foot radio telescope there, have been engaged in a continuing research program. They have picked up radio signals from the sun, Mars, Jupiter and Venus, which among other things have given us a better idea of the temperatures of these planets. Research through radio astronomy also supplies a great deal of information about the propagation of electromagnetic radiation through space, and through the ionosphere and troposphere, and thereby contributes to the development of various types of *electronic equipment.*

Field of Communications

Basic research in electromagnetic propagation has been directly responsible for the remarkable progress we have been making in the field of communications. Just in the past year Navy research projects have studied intensively the propagation of a very low frequency radio signal by mechanisms which we have only recently learned to understand.

One of these involves sending a signal from one point on the surface of the earth to another point along a path which travels many miles into space. This mechanism may also tell us something about the materials that are present a few thousand miles out into space.

We are expending considerable effort on the study of communication by means of signals that are reflected or scattered from the ion trails put out by meteors entering the earth's atmosphere. We expect that this may eventually result in vastly improved medium-range communications.

Radio Relay Station MOON

One of the most significant achievements in the field of radio communications is the discovery by Navy scientists that the moon can be used as a radio relay station. The Naval Research Laboratory recently reached this conclusion after six years of experiments involving the bouncing of radar signals off the moon. Research was begun in 1951 as part of a long-range research project to study the moon by radar, which would benefit both radio communications and radio astronomy.

Research Leading to Transistors

Basic research also supplies the fundamental information necessary to evolve new types of components for electronic uses. For example, a Navy-sponsored research study on the properties of semi-conductors has supplied much of the basic information that has made possible the development of *diffusion transistors* which can be mass-produced. In addition, they have the capability of operating at much higher frequencies than the older types of transistors. This break-through in the transistor art not only assures that reliable units can be produced at relatively low cost but also permits the utilization of transistors in a new class of applications.

In the area of materials, research developed silicon and germanium as a substitute for rare selenium and actually gave us devices superior to those made from selenium.

Building Blocks of the Universe

Another program in which the Navy is greatly interested is the study of *elementary particles,* which may be considered the basic building blocks of the universe. By observing the production and interaction of these elementary particles we can gain important clues to the prime motivating force of life.

The answers we learn will give man a greater mastery of his environment than was ever thought possible. However, the accomplishment of this goal requires the use of high-energy particle accelerators to provide the large amounts of energy needed to induce the interaction of these particles. We are seriously concerned because the United States has only two accelerators capable of efficient production of these particles, and these two cannot meet the demands of the situation.

High Temperature Alloys

In the field of high-temperature materials, research supported by the Navy, is effecting continuing improvements

in *molybdenum-base alloys*. New molybdenum alloys have been developed which have strengthened properties more than three times those of presently used high-temperature alloys. It now appears that certain molybdenum alloys may be useful at temperatures as high as 2500°F, and for some short time applications above 3000°F. There is obviously considerable interest in the use of these alloys for missile and jet engine components.

Upper Atmosphere Research

Another Navy program helping to bring us closer to the wonderful world of the future is upper atmosphere research. If our aircraft are to navigate at heights approaching 100,000 feet at speeds of *Mach 5* or more, we must have more accurate information about air density, pressures, and temperatures as well as cosmic radiation at those heights. At the same time, if we are to accomplish any considerable improvement in radio and television communications, navigation, and long-range weather forecasting, we must know a great deal more about the ionosphere, which exists at levels of between 40 and 400 miles above the earth.

Since 1946, the Navy has pioneered in the development and use of both *rockets* and *high-altitude plastic balloons* as major research tools in this field. One Navy-developed rocket, the *Aerobee-Hi*, went to 193 miles during the past year, a record for single-stage research rockets. This rocket is now playing a prominent part in the upper atmosphere research program of the International Geophysical Year.

Our plastic balloon program supplements rocket research since balloons can remain in the upper air for several hours, a rocket only for a few minutes. Unmanned balloons in the Navy's *Skyhook* project have reached heights of about 25 miles, while manned balloons in our Stratolab project are capable of carrying observers with their scientific instruments to altitudes of over 100,000 feet. The development of these plastic balloons through the long-term research programs of the Navy paved the way for the recent record-breaking manned balloon flights of the Air Force. Navy research also initiated the method of launching a rocket from a balloon. The Navy *Rockoon*, which is a small *Deacon* rocket launched from a *Skyhook* balloon, is providing an inexpensive means of investigating the upper reaches of our atmosphere for the IGY.

Project Stratoscope

The newest Navy balloon project was completed just a few weeks ago. This was *Project Stratoscope*, in which a telescope was carried to 81,000 feet and took the first clear, sharp pictures of the sun. This has been a long sought goal for astronomers, whose observatory photographs are obscured by the haze and dust of the atmosphere. For the first time we can hope to gain a real understanding of the sun's effect on the earth. Again as a by-product of our research for the development of these high-altitude plastic balloons, we have the *polyethylene film* in which a variety of items are packaged at the local supermarket.

The Earth Satellite

The Navy's long and successful upper atmosphere research program with rockets and balloons was a factor in the selection of the Navy to do *Project Vanguard*, the earth satellite vehicle.

There is no connection between Vanguard and any missile project whatsoever. It is entirely separate—with its own scientific team, its own contractors and engines. It is an economically run project, one in which cost has been carefully considered. Within the planned project, funding has not caused a delay.

The only time schedule to which we have been committed was to make the satellite attempt within the International Geophysical Year.

The U. S. satellite program is progressing according to plan.

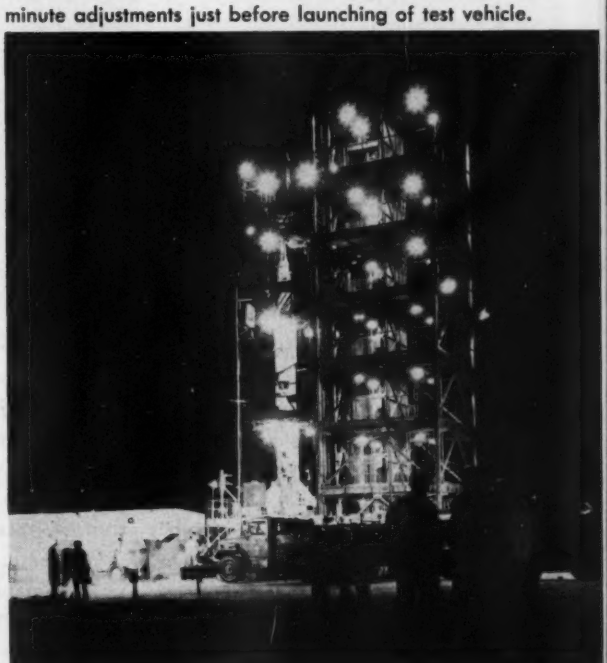
Our distant goal is, of course, manned rocket flight in space, but there are many unknowns that must be solved before we can even seriously consider such travel. We must determine the effects of cosmic and solar radiation on humans, and we are only now beginning to study their effects on living cells. Another risk difficult to assess at the present time is the probability of meteor collisions. Although this hazard has been estimated and various schemes proposed for eliminating, we have not yet reached the point where we can test any of them.

These and other serious obstacles, existing in every area connected with space flight, can only be overcome by an unremitting, relentless program of basic research. We have yet to understand fully the theory of combustion in a rocket motor. We need more research on fuels for our rockets and on high-temperature metals and ceramics.

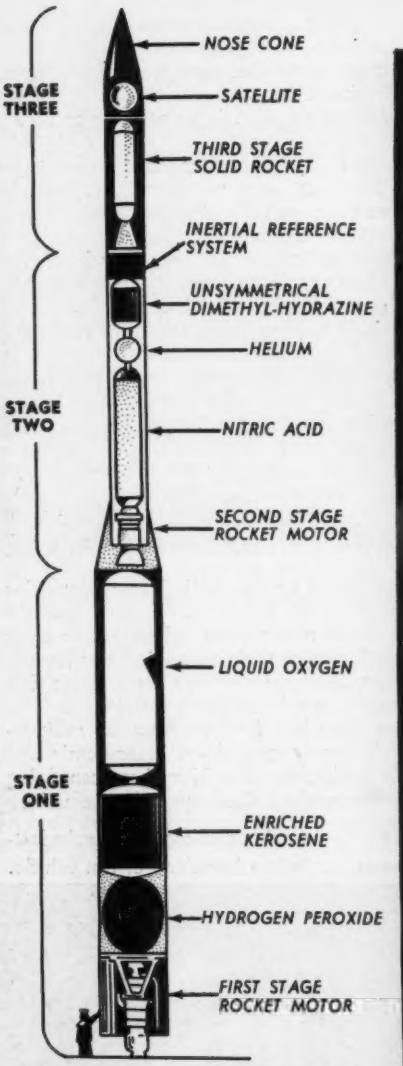
Once research shows us that radical new propulsion systems are feasible, we can advance them into the practical realm. Right now rockets and satellites are our best laboratories for space flight research. They are undoubtedly the predecessors of future space ships, but they are the remote, not immediate ancestors.

What I have described is a program of military-financed research largely carried on at academic and other non-profit institutions. The Navy has been doing this since 1945. The results, I think, speak for themselves.

POISED FOR FLIGHT—Scientists and engineers make last-minute adjustments just before launching of test vehicle.



PROJECT VANGUARD—AN EXP



The Vanguard rocket which carries the 21½-pound satellite into its orbit 300 miles above the earth is 72 feet long and weighs more than 11 tons. Its initial thrust is more than 27,000 pounds. When thrown into space, the satellite travels at a speed of 18,000 miles per hour.

This graphic illustration on Project Vanguard has been prepared by ALL HANDS Magazine in an effort to give you a better understanding of the complex Earth Satellite Program.

This is but one of a series of global experiments designed to unlock the deeper mysteries surrounding the planet on which we live. Over 8,000 scientists from 64 countries are combining their knowledge, technical ability, and enthusiasm in this gigantic effort.

The Navy's responsibility in Project Vanguard included the design, construction, and instrumentation of the satellites themselves; the design and construction of the 72-foot, 3-stage rocket; launching of the satellites and radio tracking them in space.

The satellites of Project Vanguard will whirl around the earth once every 90 minutes revealing the secrets of space. Their findings can be reported to scientists throughout the world by automatic radio transmitters packed within the satellites.

Information received from these manmade moons will, in some way or another, affect the life of every person on earth. Scientists and physicists will be enabled to determine the accurate distance between continents, the exact shape of the world, the density of the upper atmosphere, and facts as to cosmic rays, X-rays, and other phenomena.

This information will bring about better weather forecasting, improved radio and television transmission, new discoveries in medicine, chemistry, astronomy, physics, and other sciences.

After spinning the [illegible] stage is separated, [illegible] is elected into [illegible]

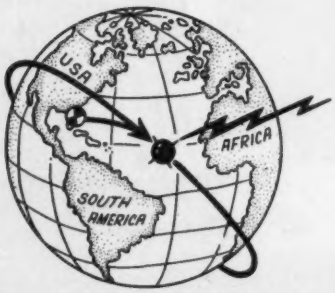
The [illegible] stage [illegible] altitu[illegible] [illegible] and [illegible] of 10,[illegible]

The first stage lifts [illegible] proximately 36 miles, [illegible] miles per hour and [illegible] seconds.

TROPOSPHERE
STRATOSPHERE
MESOSPHERE
[illegible]

LOCATIONS OF TRACKING STATIONS

Blossom Point, Maryland
Fort Stewart, Georgia
Batista Field, Havana, Cuba
Mt. Cotopaxi, Quito, Ecuador
Ancon, Lima, Peru
Antofagasta, Chile
Santiago, Chile
Antigua, British West Indies
San Diego, California
Woomera, Australia

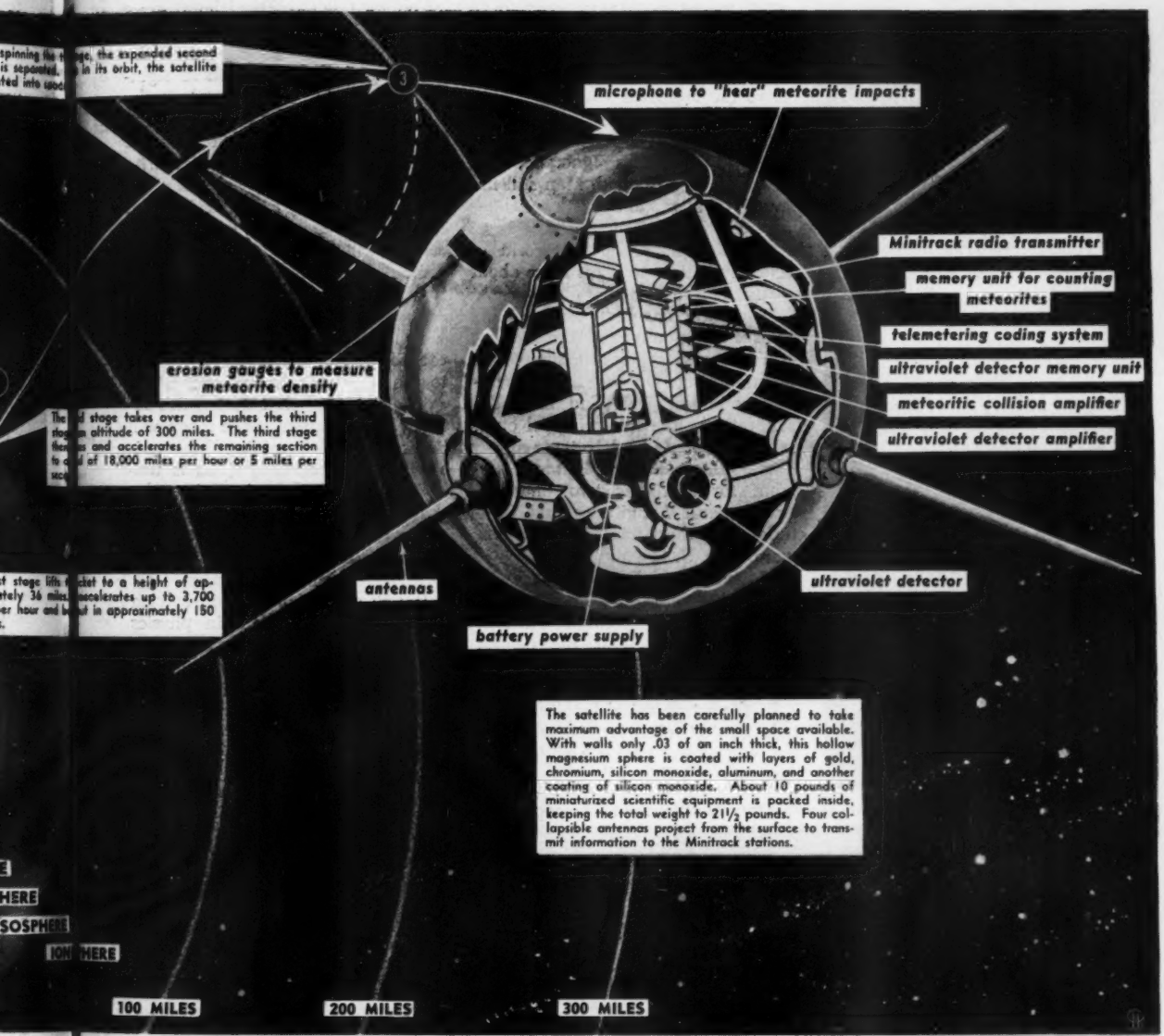


ORBIT OF THE U.S. SATELLITE

Signals transmitted by the satellite[illegible] via the Naval Research Laborato[illegible] to [illegible] Data processing systems calculate [illegible]

Prepared by ALL HANDS Magazine

—AN EXPEDITION INTO SPACE



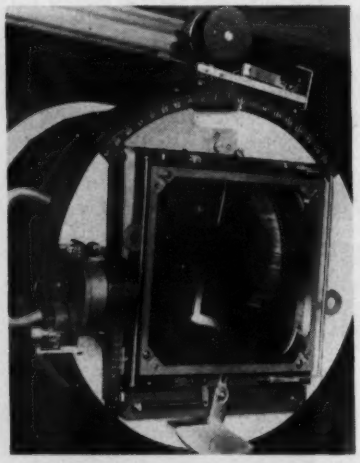
The satellite has been carefully planned to take maximum advantage of the small space available. With walls only .03 of an inch thick, this hollow magnesium sphere is coated with layers of gold, chromium, silicon monoxide, aluminum, and another coating of silicon monoxide. About 10 pounds of miniaturized scientific equipment is packed inside, keeping the total weight to 21½ pounds. Four collapsible antennas project from the surface to transmit information to the Minitrack stations.

the satellite received by Minitrack stations and immediately relayed ch Laboratory to the Vanguard Computing Center in Washington, D. C. calculate the information, and predict the satellite's path around the earth.

EXPERIMENTS TO BE PERFORMED IN THE IGY SATELLITE PROGRAM INCLUDE:

- Observations of solar radiations
- Aurora particles
- Cosmic rays
- The density of the upper atmosphere
- Micrometeors and dust in space
- Geodetic parameters
- The cloud cover of the earth
- The earth's magnetic field
- The ratio of radiation influx to the atmosphere to the radiation efflux

'BEARING 325'—Moon Position Program will benefit navigators by supplying them accurate information.



Navy and IGY—

Where's the Moon?

THE EARTH SATELLITE program is the rooster's crow in the dawn of a challenging new age—an age which finds the Navy helping to explore the unknown seas of space.

Important as it is, the arrival of this dawn does not mean that all the darkness of man's ignorance has been forever dispelled. Man still has much to learn, and earth satellites are just one part of a special effort now being made by the world of science in order to learn more about many things.

The Navy has been assigned key roles in a number of the current IGY programs besides the man-made moon project. On this and the following pages you'll find brief descriptions of the five principal ones.

Longitude and Latitude

The longitude and latitude program for IGY has two phases—Astronomical Longitudes and Latitudes and the Moon Position Program. The U. S. Naval Observatory in Washington, D. C., is one of many observatories taking part in the astronomical longitude and latitude study and it is the central agency for the Moon Position Program.

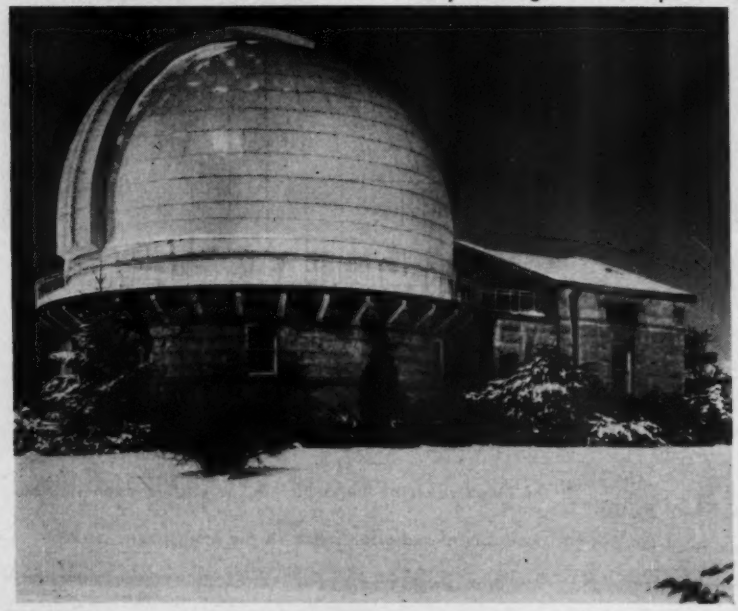
In the astronomical longitude-latitude project observatories all over the world are taking sightings to determine (within a margin of error of only a few feet) the almost exact astronomical longitude and latitude of many points on the earth. By checking the results of these sightings against those to be made in the future at the same places, it will be possible to tell whether or not the continents are shifting in relation to each other and, if they are moving, to find out how fast and in what direction.

The Moon Position Program is something new in IGY. Its principal tool is the "Markowitz camera," developed by the Naval Observatory, which makes it possible to determine the position of the moon in relation to the stars quickly and accurately.

The data gathered during this intensive observation of the moon will be useful in: determining Ephemeris Time more accurately (this is uniform time); detecting irregular changes in the acceleration and speed of rotation of the earth; and measuring the size and shape of the earth.

It will also be helpful in solving a fundamental problem in physics concerning relation between gravitation and electricity; that is, whether time scales of Ephemeris Time (which is based on action of gravitation) and atomic time (which is based on electrical forces affecting the atom) are equivalent.

SCIENTIFIC IGLOO—One of Naval Observatory buildings. *Rt:* Telescope with moon camera. *Above:* Camera close-up.



What's in the Ocean?

ACCORDING TO ONE of the scientists on the panel in charge of the American IGY program for oceanography, we know less about the 70 per cent of the earth's surface which is covered by water than we know about the face of the moon. The Navy, along with such well known research centers as the Scripps Institute of Oceanography at La Jolla, Calif., and the Woods Hole (Mass.) Oceanographic Institution, hopes to remedy that situation during IGY.

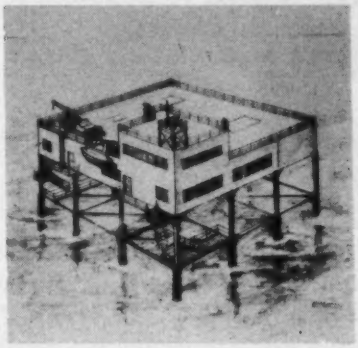
The oceanography program is divided into two major parts—the Island Observatories Project and Operation Deep Current. Information gathered in these operations will be used to answer important questions about long-range weather forecasting; the fertility of ocean life as it is affected by the exchange of water between deep ocean currents; possible dangers in using the oceans as dumping places for the waste products of radioactive substances; the shape of the deep sea floor; and the changing levels of the ocean.

Although you'd never notice it on board ship, sea level varies with the seasons. For instance, in the northern hemisphere's spring the northern parts of the ocean are about half a foot lower than they are during the rest of the year. In the southern hemisphere's spring the same is true down under. The changes seem unimportant, yet they offer a key to the circulation of water throughout the earth's oceans. This, in turn, affects climate and weather all over the globe.

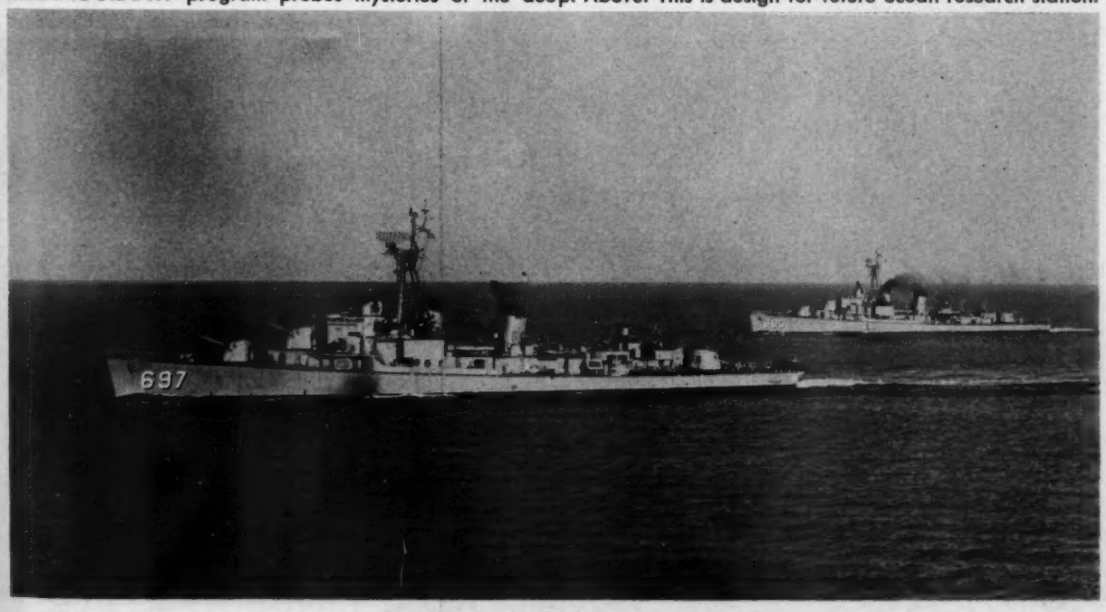
Understanding these sea-level changes and their relationship to other phenomena of the ocean and the atmosphere is the main objective of the Island Observatories Project. Until now, most of the existing information on tide levels has come from tide gauge stations in the northern hemisphere. During IGY, however, about 30 additional stations are gathering this data.

Operation Deep Current, the second part of the oceanography program, involves about 70 American and foreign ships in both the Atlantic and Pacific Oceans. Scientists on board these ships are studying the deep circulation of water moving northward from Antarctica into and along the bottom of the two major oceans; the equatorial current systems in the Atlantic and Pacific Oceans; and the areas in the north central Pacific and north central Atlantic where ocean currents converge. In addition, many of the ships are measuring the ocean bottom to obtain profiles of the land beneath the sea. —Jerry Wolff

CREW MEMBERS of *USS San Pablo* (AGS 30) lower Nansen bottle used to gather sea data from way down.



OCEANOGRAPHY program probes mysteries of the deep. *Above:* This is design for future ocean research station.



NAVY scientists have traveled to great heights to study cosmic rays.

Navy and IGY—

Chasing Cosmic Rays

FOR YEARS SCIENTISTS have been trying to learn more about cosmic rays, believed to be streams of electrically charged particles, which bombard the earth from all directions and have energies measured in millions of millions of electron volts.

The actual particles from space seldom reach the lower atmosphere, but collide with atomic nuclei in the ionosphere or stratosphere to produce showers of secondary cosmic rays composed of atomic fragments. From these fragments the properties of the primary rays can be deduced, but where the original rays come from, and how they travel to the earth, no one knows.

There is a decrease in cosmic ray intensity during some magnetic storms and a large increase, apparently related to solar flares, has been observed. There is also a world-wide variation of cosmic ray intensity with the sun-spot cycle. However, although these things are known, the reasons behind them are still a scientific puzzle.

For years it was thought that cosmic rays were a form of electromagnetic radiation similar to X-rays but of much shorter wave length. However, this theory has now been discarded by most scientists as a result of experiments conducted during the last IGY (1932-33), when it was discovered that the rays were subject to deflection in the earth's magnetic field. This led to the present-day belief that the radiation consists of charged particles, rather than electromagnetic waves, since such waves are not subject to deflection by magnetic or electric fields.

Because cosmic rays change their nature as they get closer to the earth they need to be measured and identified at different altitudes. For that reason balloons and rockets have become increasingly important.

The joint program of the Office of Naval Research and the Atomic Energy Commission has pioneered cosmic ray investigations at various latitudes from the Equator to the North Pole, and the Naval Research Laboratory is among the leaders in this type of research. As part of IGY it is stepping up these investigations considerably, launching rockets, balloons and rockoons (combinations of rockets and balloons) from many parts of the earth to gather clues.

The Navy is also cooperating in the shipboard launching of balloons and rockets by scientists from various civilian research institutions.

ROCKETS and balloons are source of high-altitude cosmic ray info. *Above: Deacon* is readied near North Pole. *Below: Skyhook* is prepared for launching.

IN PERSON—Scientists use special lab to gather cosmic ray information.

Rockets for Research

SINCE THE END OF WORLD WAR II rockets have become a vital research tool in many of the earth sciences. With them and the instruments they carry, man can safely explore heights so great that he may not be able to reach them in person for many years. And, through their ability to "see" from high above, rockets can also be a great help in learning more about the earth.

During IGY, rockets are being used for research work in six of IGY's 11 scientific disciplines. Because rockets are so important and, because they involve special facilities, techniques and operational problems, they have been made a separate part of the American IGY effort.

The Navy has been given a key role in the rocket program, and before IGY is over it will have figured in well over 100 launchings. The rockets fired in these experiments will be the:

Aerobee, a simple, reliable and relatively inexpensive rocket capable of reaching altitudes of over 100 miles.

Aerobee-Hi, which has reached an altitude of 180 miles and is the largest rocket to be used by the United States in the upper atmosphere research program of IGY.

Nike-Deacon, a two-stage combination which can be used for reaching heights of about 70 miles.

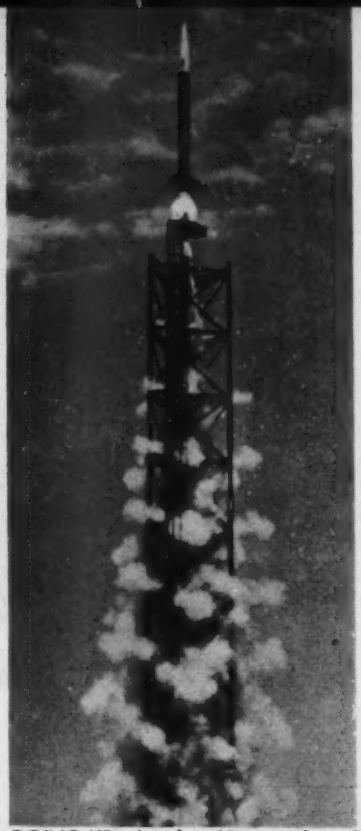
Deacon, which can be fired from *Skyhook* balloons to altitudes of more than 60 miles.

Hawk, another balloon-launched rocket, which can be used in the 70- to 80-mile attitude range.

These rockets are being used to gather data on such things as air pressure and density, temperature and winds in the upper atmosphere; the chemical and ion composition of the air at various altitudes; auroral particles; and cosmic, ultra-violet and X-rays.

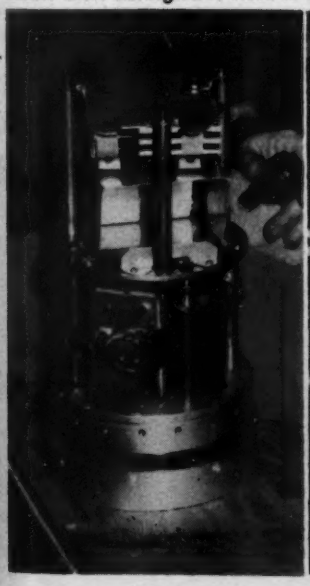
In some fields rockets could find the solutions to problems which have been bothering the experts for years. For example, the character of solar radiation at the bottom of the atmosphere is known to be considerably affected by the absorption of high-energy photons (units of visible light) in the exosphere, ionosphere and ozone layer. Ground-based measurements cannot indicate which of the sun's radiations are responsible for producing these different layers. Speculation on such subjects as the relation between solar flare radiations and sudden ionospheric disturbances fill many volumes. Yet, just one rocket flight could provide the answers that would replace this speculation with fact.

—Jerry Wolff



GOING UP—*Aerobee-Hi* is another of the Navy's research rockets: *Below: Deacon* rocket about to be launched.

HIGH FLYING LABS—Research rockets will carry many complicated instruments aloft during IGY. Here is a sample of *Deacon's* information collectors.



SNOW BIRD—Copter takes off from *USS Atka*. Note science buildings of Cape Adare Station in background.

Navy and IGY—

Deep Freeze III – In High Gear

THE NAVY'S BIGGEST assignment in the Antarctic phase of IGY is "Operation Deep Freeze," the monumental task of setting up and supporting seven American scientific outposts at the bottom of the world.

The preliminary work for it got under way back in December 1954, when USS *Atka* (AGB 3) set out to reconnoiter possible sites for the bases that were to be established in Deep Freeze I, which lasted from October 1955 to March 1956. During Deep Freeze I, two self-sustaining bases were established on the Antarctic coast—one on McMurdo Sound, where an air operations facility was set up to serve as the staging area for the establishment of an IGY station at the South Pole, and the other at Little America V on Kainan Bay, which was to be headquarters for the American IGY effort in Antarctica. Men and equipment were left at these bases through the Antarctic winter so that the work of Deep Freeze II could get off to an early start the next year.

Men, ships and planes for Deep Freeze II began arriving in the Antarctic in October 1956. The main objectives for this phase of Deep Freeze were to resupply and expand the Little America V and McMurdo Sound bases and to set up five new scientific stations — Amundsen-Scott IGY Station at the Pole itself, Byrd Station in Marie Byrd Land, Adare Station on Cape Hallett, Wilkes Station on the Knox Coast and Ellsworth Station on the Filchner ice shelf. The job was completed in

SUPPLIES for a long winter are delivered at Cape Adare. *Right:* RADM DUFEK and CAPT Hawkes at South Pole.

March 1957, and Navymen and scientists were left at each of the sites to spend a long, lonely winter in the world's coldest climate.

Deep Freeze III is now in full swing. During this phase of the operation, which started in August, the seven American outposts are being resupplied, worn-out equipment is being replaced, additional buildings are being erected and the wintering-over parties left by Deep Freeze II are being relieved by other Navymen and scientists. The fourth and final phase of Deep Freeze will be completed early in 1959.

Deep Freeze is part of a good-sized invasion. More than 1800 men were involved in its first phase, over 3500 participated in the second and better than 4000 are now engaged in the third.

All this effort is aimed at helping to provide the answers to questions like these:

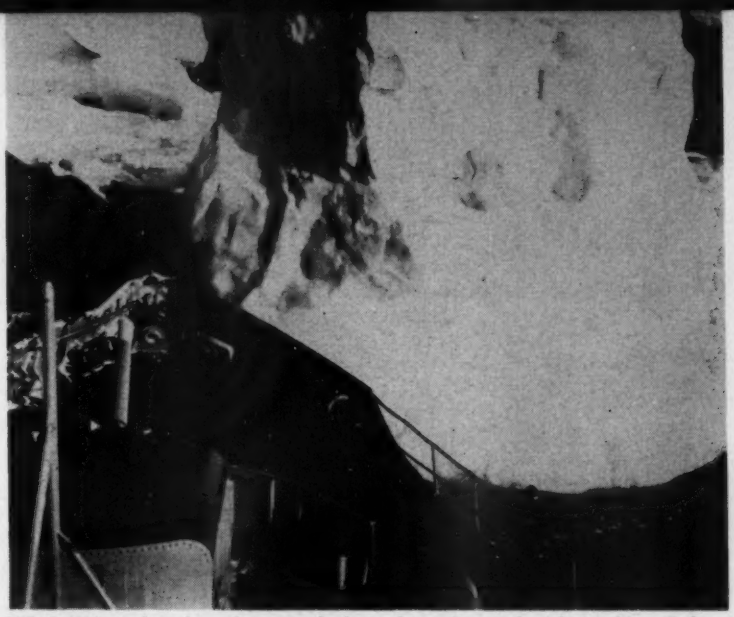
How does Antarctica's weather affect that in the rest of the world?

What relation is there between geomagnetic disturbances in the Northern and Southern Hemispheres?

What causes the increase of noise level on high-frequency radio circuits during displays of the Northern and Southern Lights (aurora borealis and aurora australis)?

Is Antarctica a true continent, or only a group of islands overlaid by an immense sheet of ice?

While the answers to these and many other questions are being sought at the bottom of the world, the word, "unexplored," will be disappearing from many places on the maps of that vast wasteland known as Antarctica. —Jerry Wolff



BIG PUSH—Icebreaker clears path through ice for replenishing ships: *Below:* Flags of three IGY participating countries are raised at McMurdo Sound.

WATCH ON THE BRINE—*USS Atka* aids icebound ship. *Rt:* Navy party plants cylinder at Gen. Erskine Bay.

HOT SHOT—This is how sun appears from 83,000 ft. with aid of Stratoscope.

The first photo flight was conducted in late September, with the balloon hovering at about 81,000 feet while the camera took 8000 photographs on 35-mm film at one-second intervals. The flight began at New Brighton, Minn., where the balloon-carried equipment was launched, and ended near Athens, Wis., after the telescope-camera was automatically parachuted from its plastic envelope.

The second photo run started at Huron, S. D., and five hours later the instrument package landed near Scarville, Iowa, with 8000 more exposures taken at an altitude of 83,200 feet.

The September effort was aimed at obtaining photographs of the solar surface near the core or center. In October the pointing device was modified so the telescope-camera could scan small portions of the sun's disk from a point halfway between the rim and the core, out to the rim and back again. Several scans of this nature were made during the flight. Regardless of where the camera was pointed on the sun's surface the resulting pictures were termed the sharpest ever taken.

The solar telescope-camera used to obtain the research photos has an aperture of 12 inches, is nine and a half feet long and weighs 350 pounds. The primary element of the telescope is a quartz mirror, three inches thick and weighing 28 pounds. A secondary quartz mirror

Project Stratoscope: Unlocking Mysteries of

PROJECT STRATOSCOPE, aimed at furthering man's knowledge of the sun and other celestial bodies, has taken its place alongside the Skyhook and Stratolab programs in the Navy's upper atmosphere studies.

In this new basic research project, scientists have dispatched unmanned balloon-carried, camera-equipped telescopes to altitudes of above 80,000 feet to obtain high quality photographs of portions of the sun's surface. The resulting sharp photographs are impossible to obtain from the highest observatory on earth. At the Stratoscope altitude 95 per cent of the atmosphere has been left behind.

In two Stratoscope flights, 16,000 photographs of the sun have been obtained. Research workers hope that these pictures will some day unlock some of the mysteries of the sun and will reveal the true size and nature of the turbulent eddies on its surface. They also hope to learn more about the communication-disturbing solar flares and, ultimately, how the sun holds its hydrogen bomb-like thermonuclear forces in check. From studies such as this may come the first thermonuclear reactor, harnessed for the benefit of mankind.

The Stratoscope program is directed by Princeton University scientists under the sponsorship of the Office of Naval Research. They sent their first balloon aloft in August carrying a dummy telescope-camera to test the automatic pointing gear.

TELESCOPE with camera (left) took sun's photo. *Rt:* Dr. Schwarzchild of Princeton and CDR Cochran check plans.

is mounted on a swinging arm so that it remains in the sun's image only long enough to obtain an exposure. About 98 per cent of its time is spent cooling so that the mirror will not be distorted nor have its aluminized coating burned off by the solar energy concentrated on it by the telescope's primary mirror.

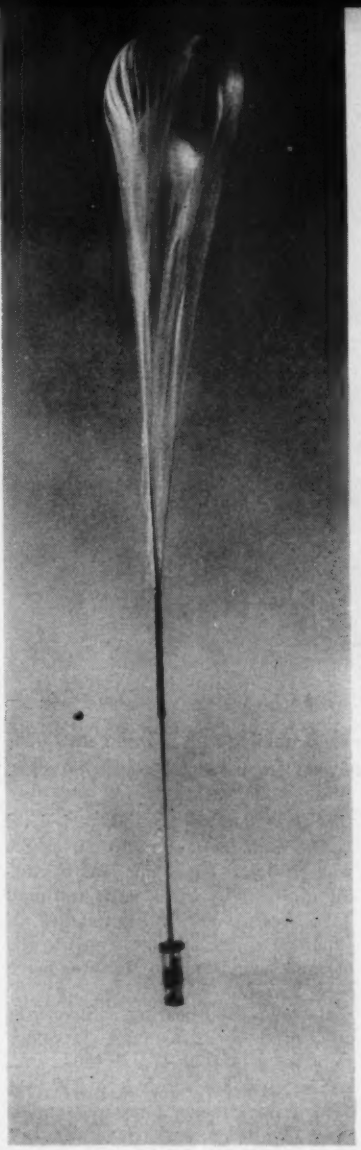
A relay lens, working at a magnification of 25, moves continuously, seeking the correct focus which may change owing to the heat of the sun changing the focal length of the primary optics. In 20 seconds this lens is in 20 different positions seeking perfect focus. Consequently only one-twentieth of the exposures are in focus. However, one good photograph is sufficient to answer many

ries of the Sun

of the questions of astronomers.

The actual aiming of the telescope is done by four sets of light-sensitive "eyes." Two sets provide the coarse and fine azimuth (or horizontal) aiming while an equal number direct the scope in vertical movement. The eyes turn light rays into electric power which determines the amount of movement made by the telescope. "Coarse" eyes, sensitive over a region of 180 degrees, bring the lens to bear on the general target and "fine" eyes direct the optical equipment to the precise point on the sun to be photographed.

The polyethylene plastic balloon that provides the stable platform for the Stratoscope camera has a capacity of more than one million cubic feet. It carries the 1300 pounds of instruments aloft at a rate of 800 feet per minute. Hanging below the balloon are a 90-foot cargo parachute, the telescope mechanism and frame and a two-foot thick crash-pad of plastic foam which reduces the shock when the telescope makes its parachute landing. The entire Stratoscope flight train is approximately 300 feet long.



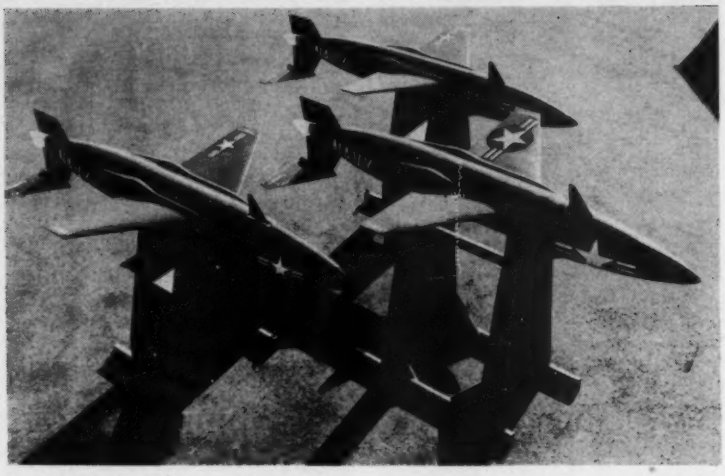
The Stratoscope flight sequence is controlled by a timer. About 105 minutes after launching, the balloon will be at its predetermined altitude where the timer turns on a telemeter transmitter, motors and electronic amplifiers. After warming up for 15 minutes the electronic gear begins to function and 14 minutes later the telescope swings down and is aimed at the target. It stays in this position for 45 minutes to allow the mirror to reach a stable temperature. Three hours after the launch the camera begins clicking and continues for 150 minutes. Then the timer turns the camera off, the telescope is latched upright for stowage and the unit is detached to float to earth beneath the parachute canopy.

No more flights are planned for Stratoscope I until 1959 when scientists hope to have replaced the camera with a TV camera and transmitter. They also have their sights set on developing Stratoscope II which they visualize as having a 36-inch telescope acting as the lens for a TV camera unit.

The Air Force Cambridge Research Center, Bedford, Mass., provided financial assistance for the solar instrumentation of Stratoscope I.

DAWN'S EARLY LIGHT—Fog shrouds preflight preparations: *Above: Skyhook* balloon and instruments seen in flight.

★ ★ ★ ★ TODAY'S NAVY ★ ★ ★ ★



THE MOST IN DRONES—Navy's new rocket-propelled target drone, *XKD4R-1*, is a small plastic high-speed plane designed for air-to-air missile practice.

Swordfish, Fourth Nuclear Sub

USS *Swordfish*, SS (N) 579, the Navy's fourth nuclear powered submarine which was launched in August, is the first to be built in a Navy shipyard — at Portsmouth, N. H. She is scheduled to join the Fleet in the fall of 1958.

Swordfish is the second of four 2400-ton *Skate*-class nuclear submarines currently being built and is the second Navy submarine to be named *Swordfish*.

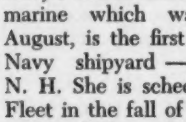
The original *Swordfish* (SS 193) was making her 13th war patrol and was operating south of the Japanese island of Kyushu when she disappeared without trace. Captured Japanese war records do not show any submarine attack in the area at that time, and the last acknowledged U. S. radio contact with *Swordfish* was on 3 Jan 1945. She was operating in a heavily mined area and may have been sunk by detonating a Japanese mine, although no records of mine explosions in the area have been found.

Before disappearing, *Swordfish* accounted for 12 major Japanese ships for a total of 47,928 tons sunk.

The new *Swordfish* is a 257-foot twin screw attack submarine, smaller than *Nautilus* and *Seawolf*, but larger than World War II Fleet submarines. Her nuclear reactor uses pressurized water as a coolant.

Swordfish will have a crew of approximately eight officers and 75 enlisted men.

YESTERDAY'S NAVY



On 3 Dec 1775 "Washington's" navy was placed in commission. On 13 Dec 1775 the Continental Congress passed legislation which raised the pay of an able-bodied seaman to eight dollars a month. On 16 Dec 1907 the Great White Fleet steamed out of Hampton Roads, Va., to begin its cruise around the world. On 21 Dec 1943 Navy aircraft from Attu, Aleutian Islands, bombed the Paramushiro-Shimushu area in the Kurile Islands. On 23 Dec 1898 the island of Guam was placed under Navy Department control following the Spanish-American War. On 26 Dec 1837 ADM George Dewey was born at Montpelier, Vt.

Silencers for Bigger Guns

To help muffle the roar of a 105mm howitzer while testing plastic cartridge cases, scientists at the Naval Ordnance Laboratory at White Oak, Silver Spring, Md., have created a silencer to mute the shattering crash of the gun to a rumble of pip-squeak proportions.

Similar in principle to the mufflers on diesel engine exhausts, the silencer is a metal cylinder five feet in diameter and 20 feet long. Inside this tank are a series of brass baffle plates and a stuffing of copper wool. At one end is a 15-foot pipe aimed at a bank of earth. At the other end the muzzle of the gun is inserted. The device enables the tremendous gas pressures to be gradually exhausted into the atmosphere at low velocities.

Although it is possible to fire a projectile through the silencer, only blank artillery rounds are being used during the testing of plastic cartridge cases. Special orifices maintain the same high temperatures and pressures in the gun breech that would exist if a shell were fired.

Plastic for Shell Casings

A newly developed plastic, similar to that now used in cabinets for portable radios, may replace steel or brass in shell casings as a result of experiments at the Naval Ordnance Laboratory (see above story).

In firing tests with a 105mm howitzer the plastic cases have withstood temperatures of over 4300 degrees Fahrenheit at the moment of explosion and gas pressures ranging from 6000 to 35,000 pounds per square inch, coming through practically undamaged. Many could be used time after time. One of the plastic cases survived six test firings.

The plastic is ideally suited for mass production techniques.

In addition, the plastic has a low brittle point, consists of non-strategic materials and could be produced in different colors to indicate different types of artillery rounds.

This research was conducted by the Naval Ordnance Laboratory for the Army. Field tests of the case will be conducted by the Army.

Sec Def McElroy Says

The Honorable Neil H. McElroy, successor to Charles E. Wilson as Secretary of Defense, believes it is the primary job of the nation's defense team "to maintain the military forces of the U. S. in such a state of power and instant readiness as to deter any would-be world ruler from launching a war against us or our Free-World Allies."

He expanded his views on his present assignment by adding, "I conceive the role of the Secretary of Defense to be that of captain of President Eisenhower's defense team. The team includes also, as top members, the Deputy Secretary, the three Secretaries, the Chairman of the Joint Chiefs and the Operating Chiefs of the Services."

Hon. Neil M. McElroy

Mr. McElroy expressed faith in the leaders of the various branches of the service. "I am confident that the men who represent the various Services on the defense team are the kind of broad-gauged men who will think beyond the point of view of the individual Services and will concern themselves primarily with the defense job as a whole.

"In my travels about the country, I found fine, devoted, patriotic, enthusiatic people—ranging from the airplane designers and nuclear physicists to the strategic bomber crews and missile artillerymen. The experience of meeting with them and absorbing a measure of their dedicated spirit was inspiring as background for this new job I am assuming. . . I look forward to my tour with the defense team."

Land Catapults

The new test site for evaluating aircraft launching received its official commissioning 1 October at ceremonies at NAS Lakehurst, N. J. Known as the Naval Air Test Facility (Ships Installations), the 4500-acre site, under construction for more than a year, is scheduled for completion some time in 1958.

Since all carrier-based aircraft must be catapulted and arrested, future combat effectiveness of carrier aviation will be greatly influenced by the test programs conducted at NATF(SI). Tests and evaluations of increasingly fast and heavy planes will determine whether or not they can be handled on the flight deck of any carrier before they are committed to a ship.

When fully completed, NATF(SI) will be the Navy's primary installation for the test and evaluation of new catapults and arresting gear.

The C13 steam catapult will be installed at one site in an elevated position to study the behavior of different aircraft types as they are launched from the elevated platform. These launchings will closely simulate actual shipboard conditions.

The C14 air-gas catapult will be installed at the other site. This catapult is powered by the internal combustion catapult powerplant and will be developed and evaluated at NATF(SI) before being installed in the Navy's first atomic carrier.

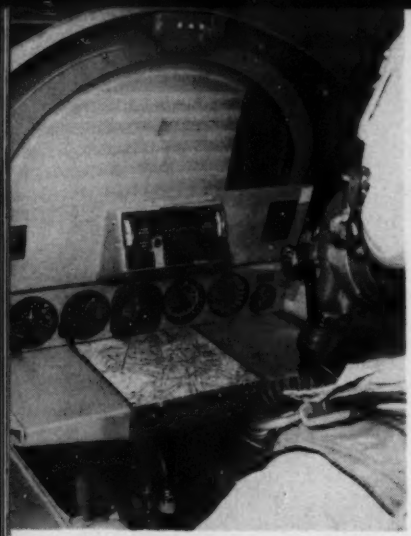
A large powerhouse is being erected adjacent to the southeast end of the runway to supply power to the catapults. On top of the powerhouse will be a small control tower which will act as the primary control center. An instrumentation shop and photo lab will also be included in the powerhouse.

A special projects building is being constructed near the taxiway leading to the land strip and catapults. It will include a hangar area and will house NATF(SI) engineering and administrative personnel. It will also include a machine shop.

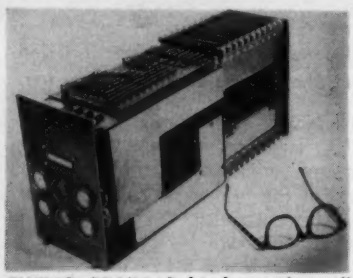
Testing of the Navy's newest aircraft launching and recovery systems with modern carrier-based aircraft will begin on full scale operations some time in 1958.

LOWER PLATES—New York Naval Shipyard workers lay keel plates for *USS Constellation* (CVA 64), sixth super carrier. She will use conventional power.

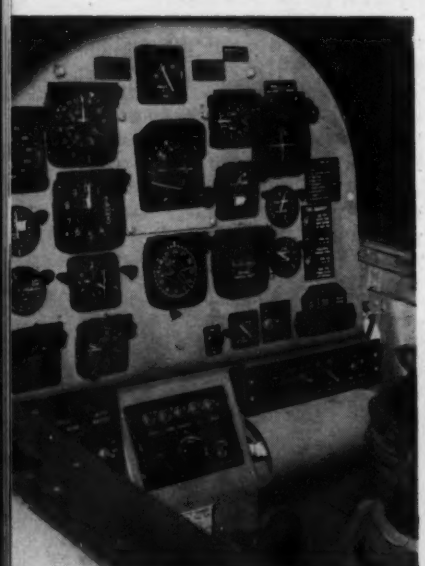
TOP ANGLE VIEW of radar picket escort vessel *USS Price* shows her speeding through Atlantic keeping a sharp lookout over, under and across the seas.



NEW INSTRUMENT panel provides more information faster with less instruments for the pilot to read.



FLYING BRAIN—Behind panel small electronic brain computes flight info.



SNOWBALLING instrumentation of old type panel to meet needs of complex jets was passing safety point.

Instrument Panel of the Future

A successfully flight-tested, cockpit instrument panel of the future has been made available to commercial airlines by the Navy and Army in the interests of air safety. The experimental computer model is one of the scientific developments resulting from four-and-a-half years of joint research to provide pilots with an improved flight instrumentation system. It has been tested aloft numerous times since 30 Aug 1957 in a high-performance Navy jet trainer plane.

The new panel, which can be used under all weather conditions, day or night, provides a television-type artificial picture of the outside world for the pilot. It not only tells him how he's doing, but provides him with information on what to do next.

Under development since April 1953, this advance in cockpit instrumentation has been a joint project of the Navy's Office of Naval Research, the Bureau of Aeronautics, and the Army Signal Corps.

The panel consists of a contact analogue displayed vertically in front of the pilot, and a mechanically operated horizontal navigational map display, together with several standby instruments.

The analogue is a two-dimensional picture, presented on a flat, transparent cathode ray tube two and five-eighths inches thick, 20 inches wide, and 11 inches high.

The picture is made up of grid lines or random dots, giving the pilot the perspective of third dimension, depicting terrain and sky information.

Signals for both the analogue and horizontal navigational display in the jet trainer are provided by a miniature airborne, electronic digital computer which accepts and processes data from nearly 20 sensors.

The digital computer serves as a bantam "answer box" which, through its electronic computations, not only shows the pilot his plane's true air speed, Mach number (speed in relation to the speed of sound), altitude and rate of climb, but also makes cruise control computations (weight, fuel, time, and distance) and comes up with performance predictions for any given set of circumstances.

The computer (or "flying brain") can make 15,000 computations a second while processing data on aircraft flight conditions. It is smaller than a breadbox and weighs less than 40 pounds.

Development of small, lightweight airborne computers was started to meet the challenge of the snowballing instrumentation and airborne control complexities of high-speed military aircraft. Where once the few needles and pointers on a pilot's instrument panel were as simple as that of an automobile dashboard, the improvement of aircraft technology brought with it an ever-increasing amount of special electronic equipment and automatic controls. There are actually hundreds of dials and switches on instrument panels of aircraft today and many pilots and engineers believe a saturation point has been reached where additional instruments and control mechanisms increase the possibility of mechanical failure or of human error.

With the new computer the electronic brain does all the calculating and navigating. Should it become necessary to change a mission in mid-flight, the pilot can simply set in the position of the new destination. The computer immediately delivers required information about the new course and informs the pilot whether or not there is sufficient fuel remaining to reach this destination.

It is expected that this type instrument panel will become operational in Navy in two to three years.

Sports at Whidbey

The over-all sports program at NAS Whidbey Island is well planned and as indicated by the number of personnel who take advantage of it, it's highly successful too. In any event, it fills many off-duty hours for sports-minded sailors.

Another measure of the program's success is the reputation Whidbey athletes have made for themselves away from the air station. Teams and individuals have carried the Whidbey banner into district, regional and All-Navy tournaments, giving good accounts of themselves whenever they compete.

The station currently boasts:

An all-Navy boxing champion—Flyweight Antonio Adame, AN, USN.

Two All-Navy tennis finalists—LTJG Lawrence Zaitzeff, USN, and LTJG Robert Nott, USN.

So far as team honors go, NAS Whidbey has made a habit of dominating athletics in the 13th Naval District for the past few years.

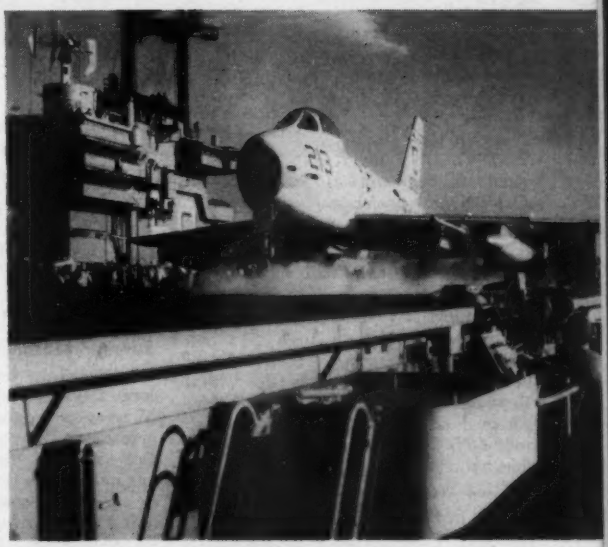
Snakes in Space

THERE IS A NEW KIND of serpent nowadays that is the talk of Navymen, but unlike the old-time sea serpents there is nothing fictitious about this flying critter that spits a deadly fire.

It's the Navy's air-to-air guided missile *Sidewinder* that was named after the equally dangerous western rattler. Both Atlantic and Pacific Fleets have planes that sport this nine-foot metal viper. *Sidewinder* finds its way to the target by means of a "heat homing" guidance system. During its first public demonstration it left no doubt as to its accuracy as the fighter firing it knocked the target drone out of the sky with the first shot.

In addition to being a highly effective air-to-air guided missile, *Sidewinder* is simple and inexpensive.

Top: Sidewinder is carried into the sky by FJ-3 *Fury* and *(Rt)* F9F-8 *Cougar* jets. *Right Center: Fury* with *Sidewinders* is fired from catapult. *Lower Right:* Guided missileman raises *Sidewinder* armament pin to signal pilot his plane is armed and ready. *Lower Left:* Ordnancemen attach *Sidewinder* to launcher on starboard wing of plane.



LETTERS TO THE EDITOR

This section is open to unofficial communications from within the naval service on matters of general interest. However, it is not intended to conflict in any way with Navy Regulations regarding the forwarding of official mail through channels, nor is it to substitute for the policy of obtaining information from local commands in all possible instances. Do not send postage or return envelopes. Sign full name and address. Address letter to Editor, ALL HANDS, Room 1809, Bureau of Naval Personnel, Navy Dept., Washington, 25, D. C.

Rotation Data Card

SIR: A rotation data card was sent to my CO about six months in advance of the expiration date of my shore duty. On 15 Mar 1957 I was ordered by Shorvey to sea, reporting aboard 9 Apr 1957. Now, when will I receive my Seavey rotation data card—this one to make my shore duty selection from sea when I'm eligible?—L. H. D., HMC, USN.

• *It will take just about the same amount of time, chief. When you qualify for the Seavey, your data card will be mailed to your commanding officer approximately six-and-one-half months before the beginning of the 12-month period in which you will be ordered ashore. Your rate falls in Segment 3. Rotation data cards for segment 3 are mailed on 15 June. The Chief of Naval Personnel commences to issue orders in October for transfer in January.*—ED.

Clothing Allowance

SIR: *NavCompt Manual*, paragraph 044155, grants the initial clothing monetary allowance to enlisted members when they *first* enlist in the Regular Navy. BuPers Inst. 1020.4A says that Naval Reservists receive their issue of clothing when they enter the Naval Reserve rather than upon reporting for active duty.

If both are right, what happens to a man who receives the clothing issue as a Naval Reservist, is discharged, then enlists for the first time in the Regular Navy?—G. E. J., SKC, USN.

• *He would be entitled to credit of a clothing monetary allowance of $189.97, in accordance with "NavCompt Manual," paragraph 044155.2a*—BUT, *read on.*

Upon enlistment in the Regular Navy, the monetary value of the clothing issue in kind, which he received on inactive duty as a member of the Naval Reserve drill unit, would be checked on his pay record, and he would be issued clothing to complete a full bag.

The monetary value of this newly-issued clothing would be checked against the $189.97—ED.

Reversion to Enlisted Status

SIR: Before being commissioned in June 1956 as ensign, USN, through the Integration Program I was a sonarman, first class. I have since been informed that after accepting a permanent commission I am no longer eligible to revert to an enlisted status. Is this true?

If I am eligible, what rating would I be reverted to?—ENS R. H. L., USN.

• *You were commissioned under the authority of Public Law 631, 77th Congress, which does not provide authority for reversion to former enlisted status. Section 6 of the law sets forth the following terminal provisions to be exercised by the Secretary of the Navy: "The Secretary . . . under such regulations as he may prescribe, may revoke the commission of any officer on the active list appointed pursuant to this act who, at the date of revocation, has had less than seven years of continuous commissioned service in the Navy, including service as a commissioned warrant officer, and any officer whose commission is so revoked shall be discharged from the naval service."*

Of course it is possible to resign a commission and request authority to reenlist under continuous service as authorized by Article C-1403 (2) of "BuPers Manual." The needs of the service would be the deciding factor in the Navy's consideration of your reenlistment request and the rating which would be authorized.—ED.

WOs in Nuclear Power Program?

SIR: There's plenty of information concerning qualifications for enlisted men and junior officers for the nuclear power submarine program, but nothing specifically for warrant officers for the surface program. Can you supply me with specific information on how a warrant machinist can get into the nuclear power program for surface ships?—L. E. K., MACH., USN.

• *Sorry, but at the present there are no provisions for warrants to enter the nuclear power program. So far this need has been met from within the program by qualified trained enlisted men already in the program who have made warrant. But this doesn't mean that the door is closed indefinitely to warrants.*

As a suggestion to you, and to any other warrant who is interested in the nuclear power program, indicate your desire for this duty on your data card to the Bureau. This will allow the detailers to have the information on hand if and when there is a requirement.—ED.

How to Wear Medals

SIR: Since medals came back into style for the full dress uniform the proper method of wearing them has been the subject of many arguments and several different interpretations. *U. S. Navy Uniform Regulations* (Chapter 15, section 1521, paragraph 5) states if there are more than three medals they shall overlap. The problem which confronts everyone is this: If a man has six medals does he wear two rows of three or must he wear five overlapping and one on the top row?

In the case of more than six should the lower row always be five with a lesser number in the top row?

I contend that if a person has six medals or more the bottom row must contain five with the remaining ones in the next higher rows even if the second row only has one or two medals. Of course, I am aware that a person may wear only his five senior medals if he wishes.—P. T. B., LCDR, USNR.

• *After checking with our medal authorities we have learned that a man who has six medals may wear either three, four or five medals on the lower row. Consequently the upper row would contain three, two or one award. The requirements are that the lower row may not contain a lesser number of medals than the row above; also, if a row contains more than three medals they must overlap; and a row can not contain more than five medals.*—ED.

CB Shoulder Marks

SIR: The shoulder patch with the name of the ship or squadron to which a man is attached has been approved for Fleet and aviation personnel. Are there any plans for a shoulder patch for Seabee outfits?

Can you tell me when the wearing of the old Seabee emblem was discontinued?—L. E. C., CE1, USN.

• *Your letter couldn't have come at a better time, for the CB shoulder mark plans were just recently approved. Authority will be granted for enlisted personnel below chief petty officer attached to Mobile Construction Battalions to wear a unit identification mark similar to the present ship name sleeve mark. This approval will be implemented as soon as the CB shoulder marks are available.*

In answer to your second question, the old SEABEE emblem with the busy bee clutching the tools of his trades in his many hands while firing a machine gun, was discontinued in 1946.—ED.

Bowling a Perfect Game

SIR: Does a 300 game have to be rolled in league play in order for a Navy bowler to receive a BuPers Achievement Award? Or, would a 300 game in practice also count?

Where could I find information on this subject?—W. H. G., YN1, USN.

• *It doesn't matter whether the game is bowled in practice or in league play. So long as it is properly witnessed and was accomplished after 1 Oct 1954, it would still count for an award. The same applies to the award for a 700 set of three games, except that it must have been rolled after 1 Jan 1956, instead of 1 Oct 1954. The request for such an award must be endorsed and forwarded by your CO.*

Further details are contained in the "Special Services Newsletter" of June 1956.—ED.

Commissions for Reservists

SIR: I read with deep interest your May issue, particularly your article "How to Earn a Commission." I was unable to find an answer in this article to the following question: "Is there any program, formal or otherwise, whereby a member of the Naval Reserve who is a college graduate can earn a commission in the Reserve, and once being commissioned continue his affiliation as a member of the Ready Reserve?"

I believe an article or lengthy answer in your "Letters to the Editor" would be warmly received by a number of Reservists as would some information on advancement to Warrant Officer for Reservists.—F. M. S., BMC, USNR.

• *Here is the answer on Reservists who are college graduates desiring to apply for a commission. If they have fulfilled their active duty obligation, they may apply for a direct commission in certain categories without incurring any additional active duty obligation. Your Office of Naval Procurement can give you the details on this program.*

Other opportunities for Reservists who have not completed college are discussed in the August 1957 issue of "The Naval Reservist," copies of which are sent to all ships and stations.

The information you asked for concerning the Reserve warrant officer program is contained in BuPers Inst. 1120.26, but here in general are the eligibility requirements:

Must be a citizen of the U. S.

Must be a petty officer first class or a CPO.

Must have served as a member of, or have been associated with a drilling unit in a pay or non-pay status, for a period of not less than one year immediately preceding the submission of application.

Must have completed 10 years' active and/or inactive naval service including Marine Corps or Coast Guard, on or before 1 July of the year following that in which your application is submitted.

Must not have reached your 40th birthday, as of 1 July of that year of application, if you originally enlisted in any branch of the service before 30 Sep 1945; or your 35th birthday, if you enlisted after 30 Sep 1945.

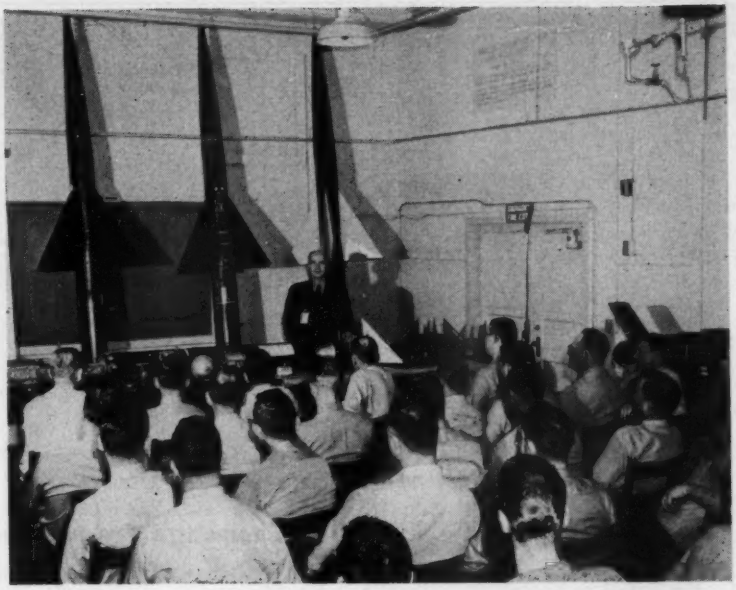
Must not have a record of conviction by court martial for two years preceding the date of examination.

Must meet the physical requirements.

Must agree to remain or transfer to the Ready Reserve for four years following appointment.

May not apply for more than one warrant officer category.

This should prove that "thar's gold in them thar hills" if you qualify.—ED.



IN HIGH GEAR—Training programs for conversion to guided missile ratings have been accelerated to meet increasing needs as more missiles join Fleet.

Gold Rating Badges

SIR: I have been trying to order gold rating badges through small stores, but the only stock numbers anyone there can find for them are on the ones for CPOs.

Since the badges are part of the uniform and I am supposed to wear them, will you please tell me how I can place an order. I know I could obtain the badges through Ships Service or the Navy Exchange. However, the price would be much higher than the price of a CPO badge in Small Stores.—J. G. J., AD1, USN.

• *As you know by now, gold rating badges are not carried in stock. Individual requirements are met by the Naval Clothing and Textile Office, Brooklyn 32, N. Y.*

Because gold PO1 badges are made up on an individual basis, there are no stock numbers for them. However, your Clothing and Small Stores outlet can still order the badges from Brooklyn for you. A deposit may be required and the order will probably take about five weeks to fill.—ED.

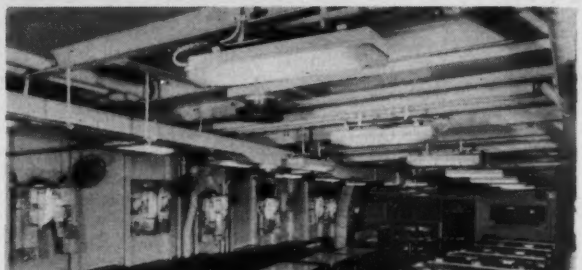
Earning Credits for G.I. Education

SIR: Several arguments have hit the bulkhead with a dead thud concerning the possibility of obtaining financial help from Uncle Sam for undergraduate and graduate schooling after completing service of the obligated time of contract NROTC officers. What are the facts?—LTJG J. O. C., USNR.

• *Since all you want are the facts, here they are. A contract NROTC officer after completing his obligated service would receive financial aid from the government for graduate or undergraduate schooling only if he is eligible for such training under the G. I. Bill. A member must have been on active duty before 31 Jan 1955 to qualify for the educational benefits of the G. I. Bill.*

This education, which equals one and one-half times the member's active service period, must begin within three years after discharge or release and must be completed within eight years after the separation date or 31 Jan 1965 whichever is earlier.

To compute the amount of government-paid education you have coming, count the number of months of active service you had during the period of 27 Jun 1950 to the date of first separation after 31 Jan 1955 and multiply by 1.5. The maximum amount authorized is 36 months even though you may have qualified for more.—ED.



CREW SPEAKS with pride about *Chemung's* new mess and rec area. *Right:* Ribbon is cut during opening ceremony.

SOME MESS—New tile deck covering displays inlaid official emblem of fleet oiler *USS Chemung* (AO 30).

Chemung's Crew Cheers Chow Hall Changeover

SIR: In preparation for a tour of duty in the Western Pacific, USS *Chemung* (AO 30) recently went through a three-month period of yard repair at Mare Island Naval Shipyard, Vallejo, Calif. During this time our 18-year-old oiler underwent a complete overhaul.

One part of the yard phase—the remodeling of the crew's combination recreation and mess hall held particular interest for the crew, since all hands from the skipper to the ship's mascot contributed their ideas for the project. Because of that interest, we are sending you some before-and-after pictures of the space, which serves not only as a mess hall, but also as a television room, ship's store and soda fountain, meeting hall and general lounge.

Some of the ideas incorporated in the new design were: Rearranging the outboard tables from athwartships to fore and aft, installing transom seats along the outboard bulkhead, repositioning the soft drink machine, installing curtains to partition the First Class Mess and setting the ship's emblem in inlaid tile in the deck.

The crew members take special pride in the improvements as manifestations of their own ideas and suggestions and, as you can see from the pictures, *Chemung* has good reason to be proud.—K. W. G., ENS, USNR.

• *She certainly does and so does the whole crew, for that matter. We don't know whether we can take any of the credit for giving you some of your ideas, but for the benefit of the crews of other ships due to be refitted in the near future, we invite their attention to the 'Hab Hints' article in the July 1956 issue of ALL HANDS:*
—ED.

SPECIAL CAKE was baked for opening of mess hall and galley. *Rt:* Newly overhauled *USS Chemung* heads to sea.

Physical Disability Retirement

SIR: After reading your Rights and Benefits issue of ALL HANDS I have a question regarding non-disability and physical disability retirement. If 19 and one-half years of active service fulfill the 20-year obligation for the purpose of non-disability retirement, will 19 and one-half years of active service fulfill the 20-year obligation for the purpose of physical disability retirement?—F. K., EMC, USN.

• *The answer is no and here is the reason. In the case of non-disability retirement, an enlisted man can count six months or more as a whole year for transfer to the Fleet Reserve and go out on 19 and one-half, count it as 20 years and receive retainer pay computed at the rate of two-and-one half per cent of his enlisted pay multiplied by the number of years of active federal service. But when you move into the disability retirement phase, that's a different matter.*

The requirement calls for 20 years of active service in order to be retired for disability rated at less than 30 per cent. In computing the percentage multiple to be used for figuring pay, six months or more is counted as a whole year. But the hooker here is that you must have completed *20 years in order to be eligible. For example, a man with a 20 per cent disability, even though he has 19 years and seven months of active service, will not be entitled to any disability retirement pay but he may be separated for physical disability with severance pay computed in an amount equal to two months' basic pay of the appropriate pay grade for each year of service, not to exceed two years' basic pay. But the same man with 20 years, six months and one day of active service will have credit for 21 years in computing the percentage multiple and will be retired.*

The answer is contained in Title 10, U. S. Code (formerly Title IV, The Career Compensation Act of 1949, Public Law 351, 81st Congress) Chapter 61, Sections 1201 and 1208.—ED.

No Messing Facilities

SIR: Your assistance is requested in settling a question that has been a topic of controversy among several of the officers here. This activity does not have a mess for single officers. Is extra pay for subsistance in order? If so, what would it amount to per day and what is the reference authorizing it?

Orders of officers performing temporary duty are stamped to the effect that no messing facilities are available.—A. B., CWO, USN.

• *We imagine you would like to hear that extra subsistence money is due you since a mess for single officers has not been established. However, officers are at no time entitled to reimbursement for subsistence in addition to the regular $47.88 per month while serving within the continental U. S.*

When on temporary duty or temporary additional duty, officers might be entitled to per diem at the rates and under the circumstances, prescribed in para. 4205 of "Joint Travel Regulations." Sorry we couldn't provide better news.—ED.

WEATHER OR NOT—Crew member of a hurricane-hunting Super Connie shows Reservists on training duty how weather information is analyzed.

Recognition for a Fine Crew

SIR: USS *Walker* (DDE 517) is justifiably proud of the awards that have been earned during the past two years. In bringing this to the attention of the members of the crew, who have in themselves earned these awards, *Walker* has prepared a certificate suitable for framing and for later display. Here's a copy of the certificate forwarded for your information.

The *Walker* certificate is presented to each man by the Commanding Officer upon his transfer from the ship. Career personnel treasure this certificate as evidence of their direct contribution in making *Walker* the finest in the Fleet. Personnel who are being discharged and are returning to civilian life cherish this certificate as a memory of their naval service and their direct part in making our Navy the world leader.—C. H. S., CDR, USN.

• *That's a mighty fine idea, and a mighty fine certificate. Thanks for sending us a copy of the certificate so we can pass it on to other ships of the Fleet.*—ED.

U.S.S. WALKER (DDE 517)

UNITED STATES PACIFIC FLEET

This is to certify that _____, *United States Navy,*

Served honorably on board U. S. S. Walker (DDE 517) as _____

between _____ *19__ and* _____ *19__*

By your efforts, your attention to duty, and your professional pride as a member of the crew, U. S. S. Walker established the following outstanding record which has never before been equaled by any ship of the modern Navy and will serve as an example of high Standards for the fleet for years to come.

FISCAL YEAR 1956

1. INTRA-SQUADRON COMPETITION
NUMBER 2 IN BATTLE EFFICIENCY COMPETITION
2. INTRA-FORCE COMPETITION
EXCELLENCE IN ENGINEERING AWARD – THE RED "E"
EXCELLENCE IN OPERATIONS AWARD – THE GREEN "E"
EXCELLENCE IN GUNNERY – FOUR WHITE "Es"
NUMBER 2 IN FORCE ATHLETIC COMPETITION
3 ADMINISTRATIVE
FORMAL ADMINISTRATIVE INSPECTION, MARK OF 95.3
FORMAL MEDICAL INSPECTION, MARK OF 95

FISCAL YEAR 1957

1. INTRA-SQUADRON COMPETITION
NUMBER 2 IN BATTLE EFFICIENCY COMPETITIO.
2. INTRA-FORCE COMPETITION
EXCELLENCE IN ENGINEERING AWARD – HASH MARK FOR THE RED "E"
EXCELLENCE IN OPERATIONS AWARD – HASH MARK FOR THE GREEN "E"
EXCELLENCE IN GUNNERY – ONE HASH MARK AND TWO WHITE "Es"
3. ADMINISTRATIVE
FORMAL MEDICAL INSPECTION, MARK OF 96
EXCELLENCE IN SUPPLY AWARD – HIGHEST DEGREE OF EXCELLENCE WITHIN TYPE
4. INTRA-DIVISION COMPETITION
NUMBER 1 IN DESTROYER DIVISION 253 ATHLETIC COMPETITION

This certificate is awarded to you as testimonial of your own outstanding service.

Date _____

_____
Commander, United States Navy
Commanding

LETTERS TO THE EDITOR (Cont.)

Heading for Australia

SIR: I am going out on 20 and would like to know if I rate transportation to Sydney, Australia, for myself and family. Sydney is my wife's home and we hope to make it ours.—C. L. S., MMC, USN.

• *Yes. If you certify Sydney as your home of selection on your original orders, transportation to Australia may be authorized for you and your dependents from your last permanent duty station.*

Your application for this travel should be submitted on DD Form 884, with the original and three certified copies of your orders, to the Chief of Naval Personnel (Attn: Pers B3). The certification of selection of your home should be included on your original orders and the three copies of them.—ED.

Quotas for Advancement

SIR: I have some questions about the service-wide exams held in February 1957. According to various publications, there were 26 DK1s who could be advanced to DKCA, but BuPers Notice 1430 of May 1957 listed only 22 names. I checked a few other rates and found the list in the Notice somewhat short of the total authorized to be advanced. Why weren't all the names published in the Notice or are the totals shown in the July ALL HANDS incorrect?

Why can't the multiple (final) of the lowest man in each rate who was authorized to be advanced be published? I think there are quite a few of us "also rans" who are interested in knowing how we did compared to the "last man." Seems like it would be easy to publish a "promotion zone" for each rate so that a participant in the exams could either anticipate authorization to be advanced or quit worrying about it and start aiming for the next exam.—W E. M., DK1, USN.

• *Let's get one thing straight. The totals published in the July issue of* ALL HANDS *were only estimates of what the actual quotas for advancement in the various rates and ratings would be. At the time the chart was prepared it was estimated that 26 DK1s would be advanced, but when the quotas were established only 22 advancements were called for.*

The publication of a promotion zone would be impossible for several reasons. First, they change each year in direct relation to the actual quotas for advancement. A man with a final multiple of 97.38 in 1956 may have been 10 points under the last man, but in 1957 may have been rated after acquiring the same multiple in the examinations. Secondly, a man advanced may have a final multiple of 106.10 while a man with a final multiple of 110.10 was not advanced because he did not pass the examination but did score high enough to give him a final multiple higher than a man who did pass the examination and was subsequently advanced.

Remember, a man must first pass the test before his multiple for time in service, time in grade, etc., is added to his test score giving him a final multiple. —ED.

Ship Reunions

News of reunions of ships and organizations will be carried in this column from time to time. In planning a reunion, best results will be obtained by notifying The Editor, ALL HANDS Magazine, Room 1809, Bureau of Naval Personnel, Navy Department, Washington 25, D. C., four or more months in advance.

• USS *Evea* (YTB 458)—All hands who served in this ship—formerly U. S. tug *Resolute*—and who are interested in holding a reunion in the summer of 1958 in either Chicago or St. Louis may write to John B. Greenwell, 6707 Mathew Street, St. Louis 20, Mo.

• USS *Tennessee* (BB 43)—All former shipmates who would like to hold a reunion in the San Francisco Bay Area in 1958 may write to Ben Meyer, 821 Tuolumne Street, Vallejo, Calif.

• *70th U. S. Naval Construction Battalion.* The 15th annual reunion and smoker will be held in New York City on 11 Apr 1958. For details, write to CAPT A. J. Benline, USNR, 1740 Broadway, New York 19, N. Y.

Acme of Travel

SIR: USS *Acme* (MSO 508) claims to have covered the most sea miles of any ocean minesweeper during her first year of commission. We submit the following data: Commissioned, Boothbay Harbor, Me., 27 Sep 1956; arrived Long Beach, Calif., 8 Dec 1956; deployed to Far East 4 Mar 1957; returned from Far East 13 Sep 1957. Total miles steamed during this period 26,044.

Acme is the first of the MSO 508 class, built as flagships, and is the flagship of Commander Mine Division 73. —J. W. F., LT, USN.

• *It would seem that your peers are better qualified to pass upon your claim than we are. If any of them can surpass your record you can be sure that you'll hear about it. Nevertheless, record or not, it strikes us that 26,044 miles in one year is a lot of travel.*—ED.

NOTE: Beginning in January, the subscription rate will be raised to $2.50 per year. Get your subscription now.

Here Are More Tips for the Sharp Looking Navyman

SIR: In your July centerspread on uniforms — "Look Sharp — Wear It Right!"—you say that the dress and undress blue jumpers should cover all but the lowest side button of 13-button trousers.

Uniform Regs, Chapter 11, Paragraph 1142, states that the dress jumper should "cover all but lower buttons on each side of broadfall trousers" and Paragraph 1143 says that the undress should "cover all but the lower button on each side of broadfall trousers."

My interpretation of this is that the two lower buttons on each side should show when the dress blue jumper is worn. Is that right?—G. E. R., SO1, USN.

• *Sometimes, simple things like these can be difficult to explain. What we mean is that the bottom button (singular) on each side should show when a man is wearing either a dress or undress blue jumper. According to the Permanent Naval Uniform Board this is also what is meant by Paragraphs 1142 and 1143 of "Uniform Regs."*

In other words, of the 13 buttons on broadfall trousers, 11 should be covered *by the dress or undress blue jumper. This should (if our arithmetic is correct) leave only two buttons showing. One of these should be the bottom one on the right side of the trousers and the other should be the bottom one on the left.*

Your interpretation ("two lower buttons on each side should show") is therefore incorrect if you mean that a total of four buttons should be showing.

Do we make ourselves clear this time?—ED.

SIR: Your article "Look Sharp—Wear It Right!" on the proper wearing of the Navy enlisted uniform in the July issue of ALL HANDS was interesting, timely and appropriate. It covered a subject dear to my heart; a properly and traditionally uniformed sailor is a proud, handsome man, and to accomplish this must be the first step of training.

In the article there were two references to the proper wearing of the neckerchief which, I feel, should be amplified. On the white uniform shown, the neckerchief is not tied in a square knot as specified in *Navy Uniform Regulations*. In the caption, instead of "Tie large knot" which leaves too much to interpretation, it is suggested that the wording "Tie square knot one and one-half inch on a side with neckerchief rolled loosely" be used. Again, loose interpretation of "roll neckerchief tightly" often results in a pencil thick phenomenon which is neither sharp nor salty.—E. N. Teall, CAPT, USN.

• *We appreciate your discerning eye and thorough knowledge of the proper way the uniform is to be worn. The Uniform Board agrees that the neckerchief on the Undress Whites in the illustration is not tied in a square knot but it should be, the same as the Dress Blues in the illustration. The practice of using a slip knot is not only unseamanlike, it is unsafe.*

Your recommended wording for the caption under "Neckerchief" would produce the desired result but would not be strictly in accordance with the wording as at present stated in "Uniform Regulations." By saying "Press and roll only. Do not press flat after rolling. Tie large knot" we tried to discourage the pencil-thick neckerchief you mention.

Your comments concerning the centerspread are well taken and certainly appreciated. The appearance of a Navyman wearing a properly fitted, regulation uniform does much to make the American public proud of the Navy.—Ed.

SIR: I have come across what I consider to be a breach of uniform regulations, or maybe I'm wrong. After informing several junior officers that they were out of uniform for wearing the dark, cordovan "Marine-type" shoe instead of the regulation brown shoe, I was told that this type was okayed at several of the schools they have been through.

While this situation is common among the junior officers it is, fortunately, a rare occurrence to see CPOs in other than regulation brown shoes. However, this conditon will become more widespread if officers persist in permitting the wearing of these non-regulation shoes which, at a distance, cannot be distinguished from black. Could you comment of this?—G.H.G., LT, USN.

• *You have made some very pertinent comments which point out some of the difficulties involved in strict enforcement of "U. S. Navy Uniform Regulations." A concerted effort is made in the preparation of the "Uniform Regulations" to word the description of a specific item of uniform in such a way that uniformity in appearance will result when the article is worn. On the other hand, provision is also made which permits a certain amount of discretion in choice of material and quality. It is assumed that an officer will use good judgment in the purchase of his uniforms and that he will abide with the spirit as well as the letter of the regulations.*

The Navy Department uses no special police force to see to uniform regulations but, as with other things, depends on commanding officers and others in authority for enforcement. In the specific situation that you mention, having to do with naval officers wearing dark cordovan shoes instead of regulation "brown" shoes, it is either a case of someone in authority making too broad an interpretation, in fact, a misinterpretation, of what is correct, or taking a relaxed or indifferent attitude in the execution of his enforcement responsibilities.

It is only through the efforts of interested personnel such as yourself that the high standards in appearance required of Navymen are maintained. Your interest is appreciated.—ED.

THE BULLETIN BOARD

Hankering for a Technical Education at College? Here's How!

IF YOU'RE PLANNING to make the Navy your career and feel that a more thorough technical education will improve your advancement opportunities, the Navy is willing to cooperate with you.

Through its Navy Enlisted Advanced School Program, it offers at no cost to qualified petty officers a total of four years of college-level training at either Purdue University, West Lafayette, Ind.; Washington University, Seattle, Wash.; or certain advanced naval schools.

It is looking for applicants. In its revised instruction (BuPers Inst. 1510.69B), it has raised the age limit from 25 years to 30 years, calls attention to the advancement opportunities available to those who enter the program, and reminds all hands that USNR personnel on active duty are eligible, as well as USN.

However, to make sure that the Navy also benefits, candidates are required to obligate themselves for two years' service for each year of education. If, for example, you complete the entire program, it will be necessary to serve 12 years on active duty in the naval service after your enrollment. *Four of these years will be spent at school.*

Here's how the program works:

If selected for the program you will be ordered to the Naval Preparatory School, NTC, Bainbridge, Md., or the Service School Command, NTC, San Diego, Calif., for approximately nine weeks' temporary duty under instruction. You will report during the summer before you enter college in the fall. During this time, you will face further screening and will receive preliminary instruction in mathematics and orientation.

The first period of academic training will be for two school years. During the summer, you will be ordered to duties appropriate to your rating and in line with your academic progress. You will receive normal leave during the Christmas holidays and other breaks in the academic year.

After this two-year period of schooling, you will be assigned for four years to duty in line with your training and special qualifications. Then, if still qualified, you will be eligible to apply for the second phase. If selected, you will receive orders to the proper school for the completion of your training, which will last another two years.

"I'm sorry, Sonny, but you're a bit underweight."

Courses will be designated by the Chief of Naval Personnel. During the first two-year phase, they will be general in nature and will include mathematics, physics and technical subjects. During the second two-year stretch, you will complete a prescribed engineering curriculum designed to fulfill the needs of the service. Upon completion, you will be assigned to duties associated with such fields as digital computers, advanced fire control systems, advanced armament (including nuclear weapons), nuclear propulsion and other new, advanced areas.

"What exposure you giving it?"

Each of the two educational and training phases will count as a normal tour of shore duty. If you have had previous college education, you may be integrated into the program at a level based upon your previous schooling.

You will be eligible for advancement in accordance with the career pattern described below. If you are selected for officer status, including LDO and warrant, you will be continued in the program and will be eligible for the educational programs available to officers in your category.

Enlisted personnel who are USN or USNR on active duty (including the TAR program) and who meet these requirements are eligible to apply:

- Be a male third class petty officer or above, any rating.
- Have at least three' years naval service and be not more than 30 years old by 1 July of the year originally selected.
- Be a high school graduate or possess equivalent high school level GED test scores.
- Have a GCT plus ARI equal to 118.
- Have six years' obligated service as of 1 July of the year selected if in the Regular Navy, and, if USNR, enlist in the Regular Navy for six years at the rating and in the pay grade held as of 1 July of the year in which selected. If you have less than the required six years, you must agree to extend your enlistment for periods of one through four years to meet your obligated service requirements.
- Be physically qualified.
- Be a citizen of the United States.
- Be recommended by your commanding officer.

A security clearance of Secret will be required when you are selected. You may be either married or single.

Selection will be made on the

basis of your service record and test scores. If selected, you will be issued orders in time to report to the Naval Preparatory School by 1 June. There the final selection will be made. Those not ordered to the program will be transferred to a class "B" school, unless they have previously attended such a school, and then returned to the operating forces.

Applications to take the screening test must be received by the Chief of Naval Personnel (Pers B213) by 31 December of the year preceding selection.

At present, if you are selected for the NEAS Program, you can expect your career to run like this:

- If in pay grade E-4, you can expect to be advanced to E-5, and will be converted to an appropriate rating at the time of registration.
- No matter what your pay grade, you will be authorized and encouraged to apply for Warrant (W-1) after your first semester.
- You will be authorized and encouraged to apply for the LDO and Integration programs when eligible.
- If appointed warrant or if commissioned, you will be continued in the program, and will be eligible for selection for the third and fourth years of college.
- Upon the recommendation of the commanding officer of the NROTC unit, you may be advanced: From pay grade E-5 to E-6 upon satisfactory completion of the first year of college; from pay grade E-6 to E-7 upon satisfactory completion of the second year of college, or; to the next higher pay grade upon completion of the minimum service requirements for advancement.
- If you are dropped from the program you will be authorized to convert horizontally to your former rating or to any other rating for which you are qualified and which is warranted by the needs of the service.
- You will be assured assignment to duties in line with your training and special qualifications, which now include duties associated with digital computers, advanced fire control systems, advanced armament (including nuclear weapons), and nuclear propulsion.

Details may be found in BuPers Inst. 1510.69B. See also pp. 16-19 of September 1957 ALL HANDS.

HOW DID IT START

ONR—Office of Naval Research

Compared to many other parts of the Navy, the Office of Naval Research is just a "youngster." It wasn't established until 1 Aug. 1946, which makes it just a little more than 11 years old.

Its most immediate ancestor was the Office of Research and Inventions, established a few months before the end of World War II to serve as a coordinating agency for the many research and development programs the Navy was then conducting. When ONR came into being it took over this function and was given another job that was even more important—helping to replenish the store of freshly discovered basic knowledge which is the essential raw material for the progress of applied science. Thus, ONR became the first peacetime venture by the United States government into large-scale support of basic work in science.

From the beginning ONR saw that it could best solve its own problems and plan and organize its own programs by helping to restore health and vitality to scientific research in the country as a whole. With this purpose in mind it set up its policies along lines that fully recognize and respect the scientist's need for independence and freedom.

About 80 per cent of ONR basic research is done through contracts with non-military laboratories—on the campus, in industry and in government. New knowledge and new ideas fostered by ONR are brought to the attention of the entire scientific community and result in better systems, better methods and better materials, which benefit not only the Navy but the scientific world as well.

All of ONR's scientific work is performed under its Research Group, made up of seven operating units—the Earth, Material, Physical, Mathematical, Biological, Psychological and Naval Sciences Divisions.

The projects of the Earth Sciences Division have ranged from the noise problem in connection with jet planes and missiles to Arctic geography and studies of the world distribution of disease. In the material sciences ONR has helped foster such developments as heat-resistant materials for aircraft, rockets and missiles; a munitions production method which doesn't use costly platinum; and important advances in the fields of liquid and solid propellants, fuels and power systems.

In the physical sciences ONR has played a leading role in the progress America has made in physics, nuclear physics and electronics. Three scientists have received Nobel Prizes while under contract with ONR's Physics Branch and many of today's nuclear physicists were trained under a program jointly sponsored by ONR and the Atomic Energy Commission. The work of the Mathematical Sciences Division has included such matters as improvements in the design of ships, boats, submarines, aircraft and missiles; the use of mathematics to predict the outcome of experiments without expensive testing; and programs to help overcome America's shortage of mathematicians.

The Biological Sciences Division can list accomplishments ranging from the first successful production of a virus in the absence of host cells to the development of fish repellents for protecting individuals or equipment in water. It also supported development of the germ-free animal as a valuable new research tool and was a pioneer in the field of skin tissue preservation and transplanting.

In the psychological sciences ONR has studied everything from the emergence of leadership to ways of designing equipment so that the man who runs it can do his work more easily and effectively. And, through its Naval Sciences Division, ONR has been responsible for such developments as the one-man helicopter, the rotochute for airdrops by fast-flying planes, the ejectable capsule cockpit, improvements in body armor and new pick-up gear for use in UDT operations.

This incomplete list only skims the surface of the work of ONR, but it should give you some idea of the big job this mere 11-year-old has been doing for the Navy and for science. By the time IGY is over many more items will have been added to this record, for ONR has been assigned a leading role in the American phase of that international program. It's not at all hard to see why.

EPDOPAC May Have A Mechanical Brain But It Has A Warm Heart

A SUPER EFFICIENT, coldly calculating electronic brain has been working for more than a year in close conjunction with the sympathetic human heart to write transfer orders for enlisted personnel in the Pacific Fleet. This combination, a creation of the age of mechanization, is located in the Enlisted Personnel Distribution Office of the Pacific Fleet (EPDOPAC). It's a combination that has brought benefits to the Navyman and his family.

EPDOPAC represents the Navy's recognition of the need for mechanization in the accumulation, evaluation and use of information needed by the Distribution Office. Assignment to a new duty station is, of course, nothing new. It had been going on for years before EPDOPAC was even a gleam in its creators' eyes. The present system is considered significant because it enables distribution to be made more rapidly and efficiently. To accomplish this, modern electronic data processing machines, computors and some 200 highly specialized technicians have been assembled from personnel accounting machine installations scattered throughout the Fleet.

"I'm glad they didn't make you an Admiral right away! Now you've got all those promotions to look forward to!"

Located on the North Island Naval Air Station, San Diego, Calif., EPDOPAC is under the direct command of CinCPacFlt. Its commanding officer, officially the assistant Fleet personnel officer for enlisted distribution, serves as a member of the staff of ComServPac, who is responsible to the Fleet commander for personnel distribution.

In this activity the old-fashioned clip board full of messages and letters formerly required to move a man from one type or area within the Fleet to another, is gone. Now, a working team of representatives gathered from the major type and area commanders within the Fleet can take action upon a single initiating document from either you or your command.

Before EPDOPAC became an operating reality, natural but unfortunate rumors were alive in the Fleet. Pacific Fleet bluejackets commented that they would be handled like a cup of coffee in the automat by a spark-spitting electronic personnel officer and many thought of the machines as "electronic monsters" which would be making decisions and giving orders.

Nothing could be farther from the truth. The machines are merely complex and efficient devices *which only supply information at a phenomenal rate to the familiar distribution officer who still makes the decisions.*

Teaming the fast thinking machines with the human distributor has promoted the individual sailor from merely a "boatswain who is to be transferred" to a personality with a career history, a family, a certain amount of sea and shore duty, a desired next duty station, special qualifications and, in some cases, special problems that warrant consideration.

EPDOPAC has a definite relationship to your personal well-being. In its first year of operation the organization greatly reduced the time you must spend in receiving stations, hospitals and training centers after you have been made available for transfer. This saving in time not only helps you, but with fewer people in the transfer pipeline than ever before, it constitutes a vast manpower saving for the Fleet.

EPDOPAC tells the old command sooner that it is to lose you so that a relief can be trained. Correspondingly, the new command learns sooner that you will be arriving and they can effectively plan for your employment because of the information they receive related to your skills, preferences and background.

You and your family also benefit from the speedy EPDOPAC processing because you find out sooner when you will be going and where, thus you can plan the departure.

This speed-up of information also allows the distributor more time to insure that the less desirable duty requirements within the Fleet are equally shared.

The distributors at EPDOPAC consider the individual in each transfer that is directed. They try to incorporate any special qualifications you may have, plus any personal problems and, in some cases, retirement desires if you are one of the senior citizens.

Much time and effort have been spent by the various type representatives in placing men in accordance with their skills, desires and the requirements of the Fleet.

EPDOPAC has given Pacific sailors a "Fleet Mother" whom they may contact through official channels expressing desires, stating problems, or just asking questions. A large percentage of EPDOPAC's energy is spent in answering this correspondence.

EPDOPAC is still an infant. The future holds a bright prospect for the organization, the services that it can perform and the Fleet it serves.

Career, Benefits and Travel —So They Shipped Over

In a ceremony held aboard the carrier USS *Bennington* (CVA 20), five men representing five different pay grades in the Navy, each reenlisted for an additional six years.

The quintet, with a combined total of 40 years' service behind them are: P. S. Yarick, MMC, R. E. Camp, DT1, T. J. Langston, BM2, J. H. Ponder, AC3, and G. Richardson, SN.

Each of the different rated men gave plenty of reasons for shipping over. Reasons most prominently mentioned were for career and retirement benefits, and the opportunities for travel. R. E. Camp summed up his reason by saying, "The Navy can be as honorable and as satisfying a career as any in civilian life. The advancement possibilities are limited only by the individual's ability and initiative. I feel confident that in the next six years it will afford me every opportunity to realize my full potential."

Application Deadlines Set for Officers Requesting Change To Engineering, Special Duty

Time is almost up for officers who intend to apply for engineering, aeronautical engineering or special duty designations under BuPers Notice 1120 of 10 Oct 1957. Applications must be in the Bureau of Naval Personnel (Attn: Pers B1136) not later than 1 Feb 1958.

The Notice invited applications for change of designator from certain permanent commissioned male line officers of the Regular Navy and applications for augmentation and change of designator from qualified male line officers of the Reserve, both active and inactive. The duty categories for which application can be made are: Engineering-Code 1400; Engineering (Ordnance)-Code 1450; Aeronautical Engineering-Code 1510; Aeronautical Engineering (Aerology)-Code 1530; Special (Communications) - Code 1610; Special (Naval Intelligence) -Code 1630; and Special (Public Information)-Code 1650.

Limited duty officers and permanently commissioned warrant officers (including those with temporary commissions as ensign or above) are not eligible. For Regular line officers, eligibility requirements as to rank are as follows (signal numbers are based on 1 Jan 1957 Register):

Engineering Duty (Codes 1400 and 1450)—Must be junior to signal number 9845 and not above grade of LCDR.

Aeronautical Engineering Duty (Codes 1510 and 1530)—As of 1 Jan 1957 must have been selected to or serving in grade of LT or, as of now, must be in the grade of LCDR junior to signal number 9845.

Special Duty (Codes 1610 and 1630)—As of 1 Jan 1957, must not have been above the grade of LT with date of rank of 1 Aug 1951, and must be junior to signal number 16125.

Special Duty (Code 1650)—As of 1 Jan 1957, must not have been above the grade of LT with date of rank of 1 Jun 1952 and must be junior to signal number 17302.

For Reserve line officers the requirements as to rank are:

Engineering Duty (Codes 1405 and 1455)—Must not be above the grade of LT and must have a date of rank of 1 Jul 1953 or later.

Aeronautical Engineering Duty (Codes 1515 and 1535)—Must be a LT with date of rank between 1 Jul 1953 and 1 Jul 1957.

Special Duty (Codes 1615, 1635 and 1655)—Must not be above the grade of LT and must have a date of rank of 1 Jul 1953 or later.

There are no formal educational requirements for this program. However, officers recommended for appointment will have to compete with their Regular Navy contemporaries for promotion and assignment, so they should have similar educational backgrounds. They should also be about the same age.

Applications are particularly desired from officers with baccalaureate degrees or higher and/or experience related to the field for which they are applying. Details on this and other aspects of the program can be found in the BuPers Notice mentioned above.

Correspondence Course For Aviation Electronics Technician

A correspondence course entitled ***Aviation Electronics Technician 3*** *(NavPers 91612)* is now available and the course for ***Fire Controlman 2,*** Vol. 3 (NavPers 91320-A) has been discontinued.

The new course, which has nine assignments and is good for 27 retirement points, will be administered by your local command providing your division officer finds it suitable to your rate and training program.

Those on inactive duty may obtain the course from the Correspondence Course Center by using form NavPers 580.

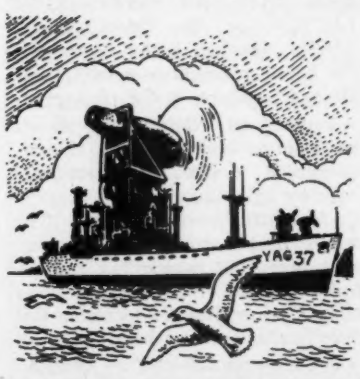
WHAT'S IN A NAME

Air Props—for Ships

A wide variety of schemes has been tried for propelling ships—from sail and wind rotors to nuclear power. But possibly one of the oddest sights a modern seagoing man could encounter would be USS YAG 37 underway.

This 14,000-ton experimental ship is completely dependent for propulsion on four 5000-horsepower aircraft turbo-propeller engines mounted on the fore and after decks.

The engines are set on 40mm gun mounts which can be controlled in train from a central station. The engines were removed from a *Constellation* airplane and the gun mounts were obtained from surplus stock.



The use of air propellers is not new. They have been widely used on small craft where underwater propulsion is not workable, such as swamp boats. And the British installed aircraft jet engines on a 1600-ton ferry boat, *Lucy Ashton*, for a series of propulsion trials to bring together model and ship resistance data.

So it was not surprising that air propellers could be used on larger ships to meet special requirements where underwater screw propulsion is undesirable or impractical because of floating debris or shallow water.

Operations were conducted at a total power rating of about 12,000 shaft HP in the interest of engine life since the engines used were developmental models. In a trial run under full displacement, YAG 37 got up to seven knots. Additional speed could be achieved by the use of propellers designed for this type of operation, but the performance with propellers designed for aircraft use was considered adequate to prove the effectiveness of the system.

The test results show the ship to be highly maneuverable with this propulsion system, actually being better than a conventional power plant at lower speeds or at a standstill. On approaching piers or mooring buoys the capability to apply propulsive force in any direction was a substantial improvement and entirely eliminated the need for tug boat assistance.

Latest List of Motion Pictures Scheduled for Distribution To Ships and Overseas Bases

The latest list of 16-mm. feature movies available from the Navy Motion Picture Service, Bldg. 311, Naval Base, Brooklyn 1, N. Y., is published here for the convenience of ships and overseas bases. The title of each picture is followed by the program number.

Those in color are designated by (C) and those in wide-screen processes by (WS). Distribution began in October.

These films are leased from the movie industry and distributed free to ships and most overseas activities under the Fleet Motion Picture Plan.

The Vintage (904) (C) (WS): Drama; Mel Ferrer. Pier Angeli.

Oh Men, Oh Women (905) (C) (WS): Comedy; Dan Dailey, Ginger Rogers.

20 Million Miles to Earth (906): Drama; William Hopper, Joan Taylor.

Hidden Fear (907): Drama; John Payne, Conrad Nagel.

The Iron Petticoat (908) (C): Comedy; Katherine Hepburn, Bob Hope.

Heaven Knows, Mr. Allison (909) (C) (WS): Drama; Deborah Kerr, Robert Mitchum.

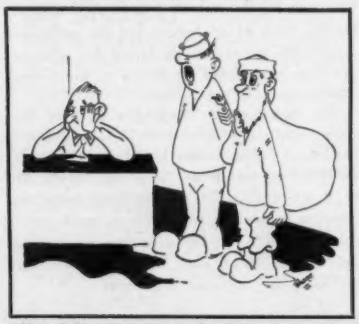
Tammy and the Bachelor (910) (C) (WS): Drama: Debbie Reynolds, Leslie Nielson.

Love in the Afternoon (911): Drama; Gary Cooper, Audrey Hepburn.

The 27th Day (912): Science Fiction; Valerie French, Gene Barry.

Beyond Mombasa (913) (C): Adventure Drama: Donna Reed.

All-Navy Cartoon Contest
Theodore Russel, PN3, USN



"He claims he was only delivering a few presents at the recruiting office."

Boy on a Dolphin (914) (C) (WS): Drama; Alan Ladd, Sophia Loren.

The River's Edge (915) (C) (WS): Drama; Anthony Quinn, Ray Milland.

War and Peace (916) (C): Drama; Audrey Hepburn, Henry Fonda.

The Buckskin Lady (917): Drama; Patricia Medina, Richard Denning.

The Fuzzy Pink Nightgown (918): Drama; Jane Russell, Keenan Wynn.

Joe Butterfly (919) (C) (WS): Drama; Audie Murphy, George Nader.

The Land Unknown (920) (WS): Science Fiction; Jock Mahoney, Shawn Smith.

The Vampire (921): Horror; John Beal, Colleen Gray.

Voodoo Island (922): Horror; Boris Karloff, Beverly Tyler.

The Pajama Game (923) (C): Musical; Doris Day, John Raitt.

Silk Stockings (924) (C) (WS): Musical; Fred Astaire, Cyd Charisse.

China Gate (925) (WS): War Drama; Gene Barry, Angie Dickinson.

Hot Rod Girl (926): Drama; Lori Nelson, John Smith.

The Giant Claw (927): Science Fiction; Jeff Morrow, Mara Corday.

The 3:10 to Yuma (928): Adventure Drama; Van Heflin, Glenn Ford.

Changes in Exam Requirements For Air Controlman Ratings

If you're planning on taking the February 1958 service-wide examination for the ratings of Air Controlman (AC), Air Controlman T (ACT)), or Air Controlman R (ACR), you had better check over the latest qualification modification. Here, in essence, is the change.

In the past, commanding officers were authorized to waive the requirement of the CAA certificate only in areas where there was no CAA certifying representative. The requirement was also waived for air controlmen not performing control-tower duties. Now, commanding officers are authorized to waive this requirement only in these cases:

- For personnel who are attached to overseas stations where it is impracticable for the CAA examiner to administer the written examination without unreasonable delay. (These stations will be specifically designated by the Chief of Naval Personnel.)
- Personnel attached to ships.
- Personnel who become eligible for waiver in the first two cases and who report *less* than six months before the advancement examination date to a command where the CAA Form 578A certificate requirement can be fulfilled.

Since personnel in all higher pay grades must possess the qualifications prescribed for the lower rates of a rating, individuals who have had the CAA Control-Tower Operators Certificates waived for advancement in the past (unless it is again waived) must obtain the certificate to be eligible for further advancement.

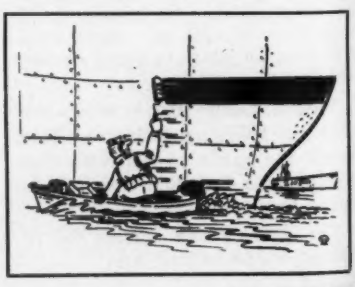
The restriction in the conditions under which waivers had been granted is due to the steadily increasing need for CAA-certified control-tower operators. Under CAA regulations, personnel advanced with such waivers are not qualified control-tower operators.

Further detailed information can be found in BuPers Notice 1410 of 15 August.

Regular and Reserve Officers Promoted to Captain, Command

Promotion of 278 Regular Navy and Naval Reserve commanders and lieutenant commanders has been approved by the President.

Lieutenant commanders selected for temporary promotion to commander are as follows: Civil Engineer Corps, 16; Dental Corps, 15; Supply Corps women, two; Chaplain Corps, 10; Nurse Corps, 51; Medical Service Corps, 40; Medical Corps, 29; Supply Corps, 61; limited duty only Supply Corps, three; Medical Service Corps women, one.



Navy Plans 'Proficiency Advancements' Following EM Exams

Proficiency advancements for enlisted personnel are tentatively planned to take effect during fiscal year 1958 upon the basis of the service-wide examinations scheduled for February.

These advancements mean a raise in pay without military advancement and are in recognition of skill in rating or demonstration of outstanding effectiveness in your assigned specialty. They entitle you to all pay and allowances of the higher pay grade but do not include military prerogatives.

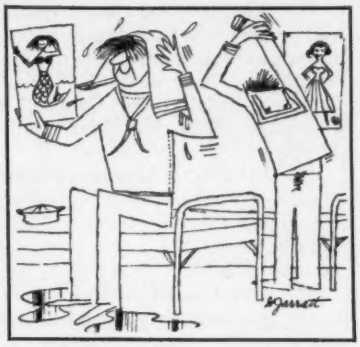
Proficiency advances will be allocated among Navy enlisted personnel on active duty in the Regular Establishment *in all ratings*. The service-wide examination system, including final advancement multiple and recommendation of your commanding officer, will be used. For proficiency advancements from rates in which there are not enough technically qualified personnel who meet time in grade eligibility requirements for military requirements, time in grade requirements will be reduced.

For other rates in which there are sufficient numbers, eligibility requirements for proficiency advances will be the same as for military advancement in petty officer grade. These advances during fiscal year 1958 will be limited to one pay grade above military grade, but they cannot be made applicable to chief petty officers as they are already in the highest enlisted pay grade provided by law. A maximum of 10,000 proficiency advancements are planned for this year.

Here are the eligibility requirements for the rates listed below:

- Six months as PO3 or PO2, and one year as PO1. Final eligibility date is 16 May.
- Recommendation of commanding officer, based on outstanding performance and technical skill.
- Satisfactory completion of practical factors, and performance tests if applicable, for the next higher grade of your rating. Completion of Navy Training Courses is not required for the February examinations for proficiency advancement in the rates listed below.

Here are the rates to which the eligibility requirements listed above



are applicable: ET2, ET3, AT1, AT2, AT3, FT2, FT3, AQ1, AQ2, AQ3, GS2, GS3, GF2, GF3, AC1, AC2, AC3, RD1, RD2, RD3, RM1, RM2, RM3, TE(RM)1, TE(RM)2, TE(RM)3, SO1, SO2, SO3, CT1, CT2, CT3, TD2, TD3, EM1, EM2, EM3, AE1, AE2, AE3, IC1, IC2, IC3, TM3, MM2, MM3, BR1, BT1, BT2, BT3, EN3, AD3, AM2, AM3, MR1, MR2, PH3, AG1, AG2, AG3, DT3, DC3, FP3, ME3, BU2, BU3, PR3, QM2, QM3, SM2, SM3, YN3, TE(YN)3, PN3, SK3, AK3, DK3, JO3, MU2, MU3.

Eligibility requirements for proficiency advancement in ratings not listed above are the same as those specified in BuPers Inst. 1430.7C. Proficiency advancements in these ratings will be awarded to the most outstanding personnel not advanced to the next military grade because of quota limitations.

If you are recommended to compete for proficiency advancement, you will be examined for the pay grade next higher than the one you are now holding. For example, if you are an RD2, and are recommended for proficiency advancement to RD2-P1, you will take the RD1 exam.

An outline of the preliminary tentative plan for implementing the proficiency program may be found in NavAct 18 (BuPers Notice 1418 of 16 October). Detailed information will be provided in a BuPers Instruction which will be distributed later.

Third Marines Lead in Memorial Stadium Fund Race

Christmas brings up the problem of presents and in this connection the Navy-Marine Corps Memorial Stadium Fund hastens to suggest that, for one dollar sent to Box 777, Annapolis, Md., a 45 rpm recording by a famous name band of "Anchors Aweigh" and the "Marine Corps Hymn" will be mailed to any address in the states, territories or possessions you designate. A card bearing your name will be enclosed. It's a nice way to handle a lot of your Christmas shopping and will bring the construction of your Memorial Stadium just that much closer.

It may not be necessary for you to send your dollar to Annapolis. Many Navy Exchanges are carrying this record in stock. (Of course, the best way to handle this problem is to buy your record at the Navy Exchange and send a contribution to Box 777, anyway.)

Funds raised in the drive so far amount to $822,000 and $1,300,000 more is needed. The Third Marine Division on Okinawa topped all comparable units recently by contributing $13,800. The Submarine Force Pacific Fleet climbed over the two dollar mark per man and is still going up. The inaugural 150-pound Army-Navy football game resulted in $18,000. Carnivals and benefits for winter and spring are being planned by many stations.

Contracts will be let in March 1958 and construction will commence shortly thereafter. The stadium is expected to be completed in 1959 ready for the three Navy football games scheduled in the stadium for that year and for other inter-service contests.

Christmas mail orders are also being taken for five dollars for an attractive letter opener which is a replica of a naval officer's sword (see ALL HANDS, November 1957, page 49).

The Memorial Chair section, for the living and dead, now ranges from John Paul Jones to men entering the service this year. Many of these chairs, which may be dedicated for $100, have resulted from letters written by men like you to friends and families who have lost a loved one in the service.

DIRECTIVES IN BRIEF

This listing is intended to serve only for general information and as an index of current Alnavs and NavActs as well as current BuPers Instructions, BuPers Notices, and SecNav Instructions that apply to most ships and stations. Many instructions and notices are not of general interest and hence will not be carried in this section. Since BuPers Notices are arranged accordin to their group number and have no consecutive number within the group, their date of issue is included also for identification purposes. Personnel interested in specific directives should consult Alnavs, NacActs, Instructions and Notices for complete details before taking action.

Alnavs apply to all Navy and Marine Corps commands; NavActs apply to all Navy commands; BuPers Instructions and Notices apply to all ships and stations.

Alnavs

No. 47—Urged wide dissemination of BuPers Inst. 111.4B, which is concerned with the nomination of qualified enlisted personnel for the NROTC program. Deadline for nominations was 18 October.

No. 48—Concerned with the rights of an accused person to be represented by counsel at pretrial investigation.

No. 49—Announced approval by the President of reports of selection boards which recommended USN and USNR officers for promotion to captain in the Medical Corps, Supply Corps, Chaplain Corps, Civil Engineer Corps, Dental Corps, Medical Service Corps and Nurse Corps; to commander in the Medical Corps, Supply Corps (men and women), Chaplain Corps, Civil Engineer Corps, Dental Corps, Medical Service Corps (men and women) and Nurse Corps.

Instructions

No. 1306.62A—Adds refinements to the basic instruction, BuPers Inst. 1306.62, which completed the criteria and procedures governing the shore/sea and sea/shore rotation of enlisted personnel.

No. 1306.66—Announces qualifications and sets forth the procedure in requesting transfer to duty as Technical Adviser at the U. S. Navy Training Publications Centers at Memphis, Tenn., or Washington, D. C.

No. 1412.10A—Announces information, procedures and regulations concerning the promotion of Naval Reserve ensigns on active duty and inactive duty.

No. 1416.4B—Announces regulations governing the professional qualifications for promotion of Naval Reserve officers who are not on active duty, or who have recently reported for active duty.

No. 1440.18A—Provides information concerning the program for adjustment of the enlisted rating structure through channeling of pay grade E-3 personnel into ratings where they are needed and through conversion of petty officers from ratings where personnel may be spared to those where they are needed.

No. 1510.69B—Outlines a program of advanced technical education and training for enlisted personnel, and tells how to apply for the Navy Enlisted Advanced School Program.

No. 1520.20A—Establishes eligibility requirements and invites applications for heavier-than-air flight training from commissioned officers and officer candidates leading to their designation as naval aviators (HTA).

No. 1560.10A—Sets forth the details of the operation of the Navy's tuition aid program.

No. 1540.27B—Describes current practices governing the heavier-than-air/lighter-than-air integration program.

No. 1910.5D—Describes procedures and requirements dealing with the separation of enlisted personnel upon expiration of active obligated service.

Notices

No. 1418 (27 September)—Announced servicewide examinations for enlisted personnel scheduled for February 1958 and provided further information on these examinations.

No. 1552 (3 October)—Notified commands of the existence of a Nuclear Power Orientation Presentation Package designed to provide illustrated, nonclassified, nontechnical material on the subject of nuclear power.

No. 1620 (3 October)—Reemphasized and supplemented BuPers Inst. 1620.2, which is concerned with the procedure for action relative to claims and complaints regarding personal indebtedness on the part of naval personnel.

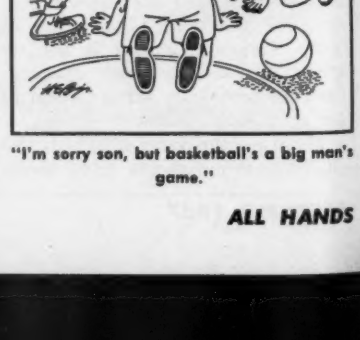
No. 1520 (8 October)—Announced the selection of officers for the submarine class convening 6 Jan 1958 at the Submarine School, New London, Conn.

No. 1120 (10 October)—Invited applications from permanently commissioned USN line officers for engineering duty, aeronautical engineering duty or special duty, and USNR officers, both active and inactive, for augmentation and designation as engineering duty, aeronautical engineering duty or special duty.

No. 1440 (10 October)—Established procedures for making changes in the CS and PR ratings to conform with modifications in the Enlisted Rating Structure.

No. 1520 (10 October)—Announced Change No. 2 to BuPers Inst. 1520.20A, which is concerned with the qualifications for heavier-than-air flight training of commissioned officers and officer candidates leading to designation as naval aviators.

No. 1301 (14 October)—Announced the procedure for assignment of enlisted men of the Navy and Naval Reserve on active duty to the U. S. Military Academy Preparatory School.



"I'm sorry son, but basketball's a big man's game."

The Time Is Now—Start Preparing For The February Exams

IF YOU'RE FOND of the better things in life (and who isn't?) you'll be happy to know that the Navy is again offering you a chance to reach for more of them—in the February 1958 examinations for advancement in rating.

In most ratings, advancement opportunities remain good, but competition will be stiff. To help you prepare for the Big Day your CO has been alerted to step up in-service training programs at your activity.

The examinations will be open to all ratings in pay grades E-4 through E-7, except for the PI and AL ratings which are being consolidated with others.

For many of those taking the exam this will be the first time their Enlisted Performance Evaluations will be used in computing advancement multiples.

Here, by pay grade, are the dates for which the examinations are scheduled:

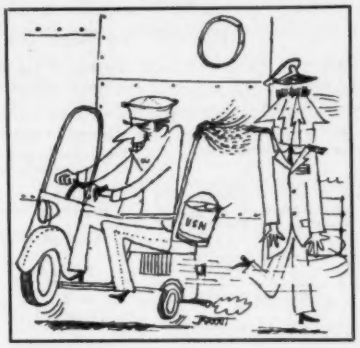
E-7 (CPO)—Tuesday 4 February
E-4 (PO3)—Thursday 6 February
E-5 (PO2)—Tuesday 11 February
E-6 (PO1)—Thursday 13 February

The examination may be taken for any one of the following purposes:

• Advancement in rating—this applies to all personnel on continuous active duty (USN and USNR, including TARs).

• Horizontal change in rating or change in rating and concurrent advancement in rating from AL to AT and from PI to LI.

• Horizontal change in rating or change in rating and concurrent advancement in rating from TE(RM) to RM and from TE(YN) to YN. Telemen (RM) or TE(YN) may participate for advancement only, for horizontal change in rating or for change in rating and concurrent advancement. Seamen in training for TE(RM) cannot compete for advancement to TE(RM)3, but they may compete for advancement to RM3. Designated TE(RM) strikers may compete for advancement to either TE(RM)3 or RM3. Since no TE(YN)3 examinations will be available this February or in the future, seamen or TE(YN) strikers in training for TE(YN) may compete for advancement only to YN3.



• Change in rating and concurrent advancement in rating to Nuclear Weapons Man (NW).

• Horizontal change in rating or change in rating and concurrent advancement in rating for personnel enrolled in courses of instruction designed to prepare them for change in rating.

• Concurrent advancement and change of rating to BR1 or BRCA by qualified personnel in pay grades E-5 or E-6 of the BT rating, or change of rating from BTC to BRC.

• Horizontal change in rating where examination has been authorized in individual cases by the Chief of Naval Personnel.

No examinations will be given for advancement to the Emergency Service Rates of CSG1, CSB1, CSR1, PRS1, PRSC, PRM1 or PRMC, all of which have been disestablished. Personnel advancing to pay grades E-6 and E-7 of the CS or PR ratings will be given an examination for advancement to the appropriate general service rate.

Regular Navy and TAR personnel in pay grade E-3, who are recommended for advancement to pay grade E-4 in the ET, FT, AD, AC, PH, AO, AQ, AB, AT, TD, AE, AM or PR ratings will be examined for advancement to a Selected Emergency Service Rate only. Reserves (excluding TARs) may be examined for and advanced to an Emergency Service Rating in their path of advancement even though that rating has not been activated for Regulars and TARs. For example, a Reserve might be examined for and advanced to, either ADJ3, ADR3 or ADP3, even though the ADP3 rate has not been activated in the Selective Emergency Service Rates program.

Regulars and TARs in the AC3, ACW3, ACR3, PR3, PRS3 and PRM3 rates who are recommended for advancement to pay grades E-5 will be examined only for advancement to the Selected Emergency Service Rates of ACW2, ACR2, ACT2, PRS2 or PRM2.

Examinations for advancement in rating to GS3, MM3, BT3, GF3, AMH3, AMS3, PRS3 or PRM3 rates are not planned for May 1958. If you failed the Nov 1957 examination for advancement to those rates you may participate in the February service-wide examination if you have maintained your eligibility and are recommended by your CO.

Personnel taking the examination for advancement in the air controlman rating may have the CAA certificate requirement waived if they: Are attached to overseas stations where it is impracticable for the CAA examiner to administer the written test without unreasonable delay; are serving on board ships; or were eligible for waiver under the above conditions and reported less than six months before the service-wide examination date to a command where the certificate requirement cannot be met.

Further details on the February examination may be found in BuPers Notice 1418 of 27 Sep 1957 and supporting instructions.

Three New Enlisted Correspondence Courses Ready

Three new Enlisted Correspondence Courses are now available.

Constructionman (NavPers 91562-1) and ***Boilerman 3*** (NavPers 91511-1), both evaluated at 18 retirement points.

Molder, Chief (NavPers 91556) is an eight-assignment course with 24 retirement points.

Enlisted Correspondence Courses will be administered (with certain exceptions) by your local command instead of by the Correspondence Course Center.

If you are on active duty, your division officer will advise you whether or not any of the above courses is suitable to your rate.

PERSONAL AFFAIRS RECORD

of

_____
(First) (Middle) (Last name)

_____
(Organization) (Service number)

I. Personal record:

1. Place and date of birth _____
(Town) (State) (Month, day, year)
2. Naturalization (if applicable)
by _____
(Designation and location of court granting naturalization)
3. Parents' names:
Father _____
(First) (Middle) (Last)
Mother _____
(First) (Maiden Name) (Last)
4. Marriage:
to whom _____
(First) (Middle) (Last)
Place and date _____
(Town) (State) (Month, day, year)
5. Children (full name, place and date of birth):
_____
_____
_____
6. Name and address of personal lawyer or trusted friend who may be consulted in regard to my personal or business affairs:
_____
(Name of lawyer or friend)
_____
(Street) (Town) (State)

II. Family records (location):

1. Birth certificates or other proof of date of birth of self and of each member of immediate family (required by insurance companies and Social Security Administration) _____
_____
_____
_____
2. Naturalization papers (if not born in United States) _____
_____
3. Marriage certificate (necessary in order to establish claims for certain payments and benefits and in connection with the will, also social security benefits) _____
_____
_____
4. Divorce papers or certified copies thereof (in case either spouse has been divorced) _____

III. Other important papers:

1. Will:
a. I have not executed a will,
(or)
b. I have executed a will:
1. Location _____
2. Lawyer's name and address _____
3. Executor's name and address _____
2. Power of Attorney:
a. I have not executed a power of attorney,
(or)
b. I have executed a power of attorney dated _____
(Month, day, year)
naming _____
(Agent or attorney in fact) (Address)
3. Income tax:
a. Copies of my Federal income tax returns and related papers are located at _____
b. Copies of _____ income tax returns and related
(Name of State)
papers are located at _____
4. Other taxes:
a. Copies of my _____ tax returns and related
(Property, etc.)
papers are located at _____

IV. Insurance:

1. My life is insured as follows:
2. Type: Government _____ Commercial _____ Both _____

Insurance Company	*Policy No.*	*Amount*
_____	_____	_____
_____	_____	_____
_____	_____	_____

3. It is payable by:
Lump sum _____ Installments for a number of years _____
4. The policies are located at _____
5. Premium receipts are located at _____
(Add in manner similar to above pertinent information thought necessary regarding property, accident, liability, or other insurance protection you may have.)

V. Social security data:

1. Social security number _____
2. Location of social security card or stub _____
3. Social security tax payments have been made. Yes ___ No ___
4. Location of up-to-date employment record, including place and type of work in each case:
_____
_____

VI. Property ownership or interest therein:

1. Real estate located at _____
a. The property is encumbered by a _____
(Mortgage, trust, deed, etc.)
Held by _____
b. Taxes on the property are paid to and including the year _____
c. The property is insured with _____
(Insurance company)
Policy No. _____ against _____
(Fire, damage, liability, etc.)
for $_____
d. The papers are located at _____
(Location of deed, abstract,
_____
mortgage, insurance contracts, and other papers)
2. (Add as many other entries as may be required to complete record as to each piece of real estate in which you have an interest.)
3. Automobile record:
a. _____
(Make) (Model) (Year) (Motor number) (Body number)
b. Under _____ dated _____
(Title number) (Month, day, year) (State)
c. It is now licensed for use by _____
d. The automobile is insured with _____
(Insurance company)
1. Against _____
(Fire, theft, damage, collision, etc.)
(and)
2. Against _____
(Personal injury, property damage resulting from operation)
3. Premiums are paid to _____
(Due date of next premium)
e. The papers are located at _____
(Location of title, mortgage,
_____
insurance, and other papers)
4. Personal property:
a. (In manner similar to above add any information thought advisable concerning other large items of personal property owned, such as a boat, machinery, livestock, goods in storage, etc.)

VII. Bank accounts:

1. _____ Account
(Checking or saving; joint or individual)
in _____
(Name of bank and location)
2. (Add as many similar entries as may be required to show all bank accounts.)

VIII. Safety deposit box:

1. Name of bank or trust company _____
Address _____
2. Location of key _____

IX. United States War or Savings bonds _____
(Where located)

1. Person designated as _____
(Co-owner) (Beneficiary)
2. Savings bonds by serial numbers and denomination _____
(Location)
_____
(This is necessary to replace lost bonds)

X. Stocks and bonds and securities owned:

_____
_____

XI. Memorandum:

1. (Enter any additional data desired regarding insurance, allotments, military record, instructions to dependents, Veterans' Administration claim number, any former service or serial number, etc.)
_____
_____
2. I do/do not desire that a copy of this statement be forwarded, together with copies of pertinent papers, to
_____
(Name) (Relationship)
_____ for his/her
(Street and number) (City) (State)
information and safekeeping.

Date: _____
Signature _____

YOUR DD 93-1 (Record of Emergency Data) is a valuable and useful document which insures up-to-date information for use by the Navy in the event of your death, serious illness or injury. However, it is an official document and is a part of your service record.

At left is an *unofficial* form which may be retained in your files for your personal use. It provides the same kind of information contained in DD 93-1.

As you will notice, it is a rundown of all the vital data needed in the event of serious accident or death. It provides a list of dependents, beneficiaries, and where all your important papers, such as insurance policies, marriage certificates, birth certificates and other documents are located. In short, it is a comprehensive record of all your personal affairs.

It is suggested that you keep it in a safe, yet readily available, spot. If carefully compiled and kept up to date, it will also be useful in filling out the many forms which face us all. You would be wise to let your wife or other responsible dependent know where it is kept so that it may be referred to in case of emergency.

Don't clip this page. Ask your personnel officer to have a copy of it made, preferably enlarged for you and your shipmates. Remember, nine other men want to see this too.

PacFleet's *Takelma* Earns 'E' With a Hash Mark

The fleet tug USS *Takelma* (ATF 113) has out-gunned all her bigger sisters in the Pacific Fleet Service Force to win the Force gunnery crown for the second straight year.

Takelma won the title in 1956 with a score of 89. This year, however, her eagle-eyed crew did some topnotch shooting and finished up with a score of 98, which they claim to be the highest mark ever attained in ServPac gunnery competition.

The fleet tug received a grade of "Outstanding" in every one of the gunnery exercises fired in the 1957 competition. Last year *Takelma* was the only ship in the Pacific Fleet Service Force to wear a Battle Efficiency "E" on every gun mount.

Top Air Units Get Three Major Naval Air Reserve Trophies

The three major Naval Air Reserve trophies which are awarded annually have been presented to the top Naval Air Reserve units for fiscal 1957.

For the second straight year NAS Minneapolis, Minn., was named winner of the Edwin Francis Conway Trophy. The award was made to the most proficient of the 28 Naval Air Reserve stations and training units competing for the trophy in fiscal 1957.

The trophy, one of the oldest continuous awards for aviation achievement, was donated anonymously to the Navy Department 22 years ago. It was set up to perpetuate the memory of LT Edwin Francis Conway, who was killed in an airplane crash in 1933.

The Chief of Naval Air Training Trophy, which is awarded to the unit showing the most improvement during the past fiscal year, was presented to the Naval Air Reserve Training Unit, Lakehurst, N. J.

Twelve organized Naval Air Reserve Squadrons and Units were named winners of Noel Davis Trophies. These go each year to the squadrons judged the most efficient of their types.

The Noel Davis Trophy was awarded to the Navy in 1927 by Harry Guggenheim, a former Naval Reserve aviator, in memory of LCDR Noel Davis, who was killed in an attempted trans-Atlantic flight.

Squadrons or units at the following stations received this award:

NAS Los Alamitos, Calif.—Air Wing Staff, Large, AWS-77(L); Air Ground Unit, Small, AGU-S 771; and Bureau of Aeronautics Reserve Training Unit.

NAS Minneapolis, Minn.—Fighter Squadron 811, Attack Squadron 813, Patrol Squadron 814 and Fleet Air Service Squadron (Patrol) 815.

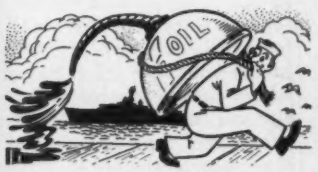
NAS Oakland, Calif.—Air Antisubmarine Squadron 872 and Airship Patrol Squadron 871.

NAS New Orleans, La.—Helicopter Utility Squadron 821.

MCAS Miami, Fla.—Fleet Tactical Support Squadron 802.

NAS Atlanta, Ga.—Auxiliary Air Unit (Large) 674.

The first of a new class of Fleet oilers, USS *Neosho* (AO 143), recently became the largest ship ever to enter the Portsmouth, N. H., Naval Shipyard. She is 655 feet long, has a beam of 86 feet, draws 35 feet of water and, when fully loaded, has a displacement approximately the same as the aircraft carrier USS *Wasp* (CVA 18).



She is equipped for the rapid transfer of petroleum products and cargo to the forces afloat operating at high speed or in heavy weather. She can carry a cargo of more than 100,000 barrels of fuel oil, 48,000 barrels of aviation fuel and 8000 barrels of diesel fuel.

***Neosho* has had plenty of opportunity to demonstrate her design characteristics. On her shakedown cruise, after commissioning 24 Sep 1954, her first operational cruise included a stopover at Aruba, N.W.I. There she loaded for transport back to the United States one of the largest quantities of fuel oil ever carried by a Navy oiler. It's little wonder that while serving with the Sixth Fleet in the Mediterranean she broke several records in fueling speed and efficiency.**

Twice she has come to the rescue of a drought-ridden area, both times in the same month. When the inhabitants on the island of Bermuda were suffering under a terrific dry spell, *Neosho* made two runs, and brought a total load of four million gallons of water.

Her defensive armament consists of automatic loading, rapid firing guns, together with the latest type of devices for their control. The latest developments in firefighting equipment are installed and her speed is considerably in excess of previous naval ships of her type.

Destroyermen Come to Aid of Grounded Freighter

When the 5000-ton Norwegian merchant freighter *Belleville* went aground off Seal Rock (near Newport, R. I.), the first ships on the scene to offer assistance were the destroyers USS *Jonas Ingram* (DD 938) and *Barry* (DD 933).

Ingram arrived shortly after the freighter's grounding but her offer of assistance was waved off because the skipper of *Belleville* didn't know the full extent of his ship's damage at that time.

Later it was determined that when she grounded on the 30-foot granite shelf, her starboard bow had been gashed open and three holds were flooded. When *Barry* made her appearance her offer to assist was accepted. A diver from the destroyer went over the side to inspect damages. His report prompted ComDesRon 20 (in *Barry*) to send over 50 men with high pressure pumps to try to get water out of the freighter. This endeavor proved fruitless however, and tugs finally took her in tow.

Nurse Corps Candidate Program Is Set Up

The Navy has set up a new program to give selected college nursing students a chance to become ensigns in the Navy Nurse Corps.

The plan calls for the annual enlistment of a number of college nursing students as they begin their senior year. These selectees will be placed on active duty in pay grade E-3 and will receive the pay of that grade, plus payments to cover such expenses as tuition, books, room and board and laboratory fees. When they receive their baccalaureate degrees in nursing they will be commissioned ensigns, Nurse Corps, USNR, and will have a two-year active duty obligation. At the time of graduation they must be between the ages of 20 and 33½.

Both this program and the present one for sending qualified Wave hospital corpsmen to civilian colleges for four-year nursing courses will now be grouped under the Navy Nurse Corps Candidate Program. Enrollees will be considered as Reserve Officer Candidates.

The program is designed to augment the present Nurse Corps procurement system of commissioning registered professional nurses directly into the Nurse Corps of the Naval Reserve.

Bluejacket Shooters Win Pistol Match

Sixteen pistol shooters representing the Pacific Fleet scored a decisive victory against San Francisco's Olympic Club in a recent .45 caliber pistol meet.

Meeting at the Alameda Naval Air Station pistol ranges in the 18th annual competition between these two teams, the Bluejacket shooters, captained by CWO Russell E. Ludwig, USN, of PhibTraPac, gained first, second and third places with their Blue, Gold and Red teams respectively.

This competition was started back in 1933 by Fleet Admiral (then commander) Chester W. Nimitz, USN. Of the 18 matches conducted since then, the Navy has won fourteen.

Fleet Admiral Nimitz was a guest at the matches and at a banquet which followed. He presented the team trophy to CWO Ludwig and the high individual score trophy to Thomas D. Elton, AO1, USN, of NAS Alameda.

Ludwig was the second highest individual scorer. The Navy Blue team fired a 2161 score while the Gold and Red teams posted 2074 and 2049 respectively.

Referee and executive officer of the match was CWO Offut Pinion, USN, the U.S. international slow fire champion of 1956 and '57.

Fond Farewell to the Fastest Ship in the Navy

USS *Reina Mercedes* (IX 25), famous water-based landmark at the Naval Academy, is finally coming to the end of her career. The former Spanish man-o-war officially completed her 45-year tour of duty at Annapolis in November.

Her passing also marks the end of an era at the Academy. Since 1912, when she replaced USS *Hartford*, she served as Station Ship continuously except for brief periods of overhaul. Until her decommissioning, she also served as headquarters for sailing activities, the Harbor Control Center, and as quarters for the commanding officer of the naval station.

One factor which led to her decommissioning at the present time was the necessity to move her because of the land-fill project now underway at the Academy.

As countless midshipmen learned the hard way, she was designated as "the fastest ship in the Navy," because she had been fast to her moorings for so long.

Course in Management of Officers Messes, EM Clubs

Officers newly-commissioned through NROTC or OCS, who hold degrees in hotel and restaurant management, are being offered a chance to continue studies along that line at the BuPers Mess Management Training Facility, NAS, Patuxent River, Md. Upon completing a two-month course at the facility they will be assigned to large shore activities as treasurers of closed messes and, in most cases, will perform collateral duties advising and assisting the management of open messes or EM clubs.

The new facility was established 1 Jul 1957 to provide technical assistance in the operation and management of officers messes and EM clubs. Its course for mess treasurers includes on-the-job training and instruction in five subjects—Accounting for Navy Messes; Food and Beverage Cost Control; Purchasing of Merchandise and Furnishings; Division Officer for Stewards, and Menu Planning.

BOOKS: THIS MONTH'S SELECTIONS ARE OUT OF THIS WORLD

THE STORY OF VANGUARD and the Navy's role in IGY can't be told in a mere 64 pages. On the assumption that you will want to know more about the famous rocket and more about space travel, we've asked the Library Services Branch to tell us about the books available at your ship or station library which will give you a more complete picture. You'll find a further rundown on books about missiles themselves on page 56 of the March 1957 issue of ALL HANDS.

Rockets Through Space, by Lester Del Ray, for example, explains why the idea of penetrating the great void of space is no longer a wild dream. *Rockets,* says the publisher, is not a science-fiction book. It deals with science facts. It tells you what we already know about the realms of the Earth's atmosphere and, through the eyes of the author, you will be enabled to examine the inside of a future rocket ship. You will also learn about the principles of jet propulsion; how men will live where there is no gravity; what dangers they will face.

Rockets Through Space is primarily concerned with the rockets and space travel of the future; G. Harry Stine, author of ***Rocket Power and Space Flight,*** and of ***Earth Satellites,*** is more interested in answering questions raised by our present-day venture into the wild black wonder. Connected with the Planning Branch of the Integrated Range Mission and busy with advanced long-range planning for electronic trajectory systems, Dr. Stine has received thousands of letters from rocket enthusiasts who want to know more about the world around them. *Rocket Power* is an attempt to answer the key questions his correspondents have raised. Interspersed with these answers are stories and experiences the author has picked up at White Sands Proving Grounds. They all add up to the fact that rocketeers are also human beings.

Earth Satellites, in a pocketbook format, discusses that crucial development of the 20th Century—man's assault on outer space. Up-to-date reading for anyone who wants to know what the future may hold for himself and our country. Dr. Stine has written many books—fiction and non-fiction—on rockets and space travel.

Another pocket-book, ***Satellite,*** by Erik Bergaust and William Beller, tells in a highly readable manner what the successful launching of an earth satellite means to the United States and to the world. The authors follow the familiar theme that launching an earth satellite is the first step toward space travel, which they predict will come about after a manned satellite is successfully launched. They state that the first trip to the moon will take off from the manned satellite, and from the moon, man will eventually travel to the rest of the solar system and then to the stars. Certainly a timely book.

To get back to hard facts and hard covers, in ***The Realities of Space Travel,*** edited by L. J. Carter, sixteen experts present the known facts about travel in outer space, outline the problems still confronting man, and tell how these are slowly being solved. Most of the field of space travel is covered: leaving the Earth and its atmosphere, combating gravity, the artificial satellite, the chemical and the atom rockets, history of rocket development, interplanetary flights, the dangers to be overcome and, appropriately enough, human limitations. The articles contained in the book all originated as papers presented to The British Interplanetary Society. Somewhat technical.

The last word on the subject may be found in ***The Space Encyclopedia;*** subtitled "A Guide to Astronomy and Space Research." So far as the usual layman can determine, it seems to be as comprehensive a volume as can be expected, with subjects ranging from "aberration of light" to "zodiacal light" and from extragalactic nebulae to the development of rocket motors. However, as explained in the preface, "no matter by how little or for how short a time, celestial mechanics and the astronomy of the solar system are united naturally with electronic and mechanical engineering; but the exploration of space would be of narrow significance if we did not look beyond our local adventure for some understanding of the universe as a whole." This has been the guiding idea in the compilation of *Space Encyclopedia.*

"You forgot to get an out of bounds pass!"

The editors of "The Scientific American" bring us down to earth with their offering ***The Planet Earth.*** Based upon the International Geophysical Year, the book discusses the origin of the earth, the lithosphere, the lithosphere's crust, hydrosphere, atmosphere, and the edge of space. The book is addressed primarily to those of us who are not scientists and is the product of a collaboration between the scientists who wrote the 14 chapters and the editors of the magazine. Combined, they go far to prove that, no matter how technical the subject, good writing can make it interesting.

Now for a change of pace.

Warm Bodies by Donald R. Morris is a bit of light reading which will bring chuckles to Navymen everywhere. This piece of fiction takes place aboard an Atlantic Fleet LST and is told in the first person by the ship's executive officer, a bachelor LTJG.

As the cast of characters unfolds you will recognize many of them as being shipmates aboard your ship. Morris showed a remarkable insight in his assignment of personalities to the secondary figures that march through the novel. Lightly woven through the chapters is the story line concerning the romance of the exec with a bright young southern girl from Little Hominy, N. C. (Little Hominy is just on the other side of Big Hominy.) As this romance progresses toward the logical conclusion, Morris has woven stories about the ship's activities and those of the crew. The book tells of Screaming Eagle, a full-blooded Indian, who would rather write home to his oil rich father for money than stand in the pay line, and of the ship's captain, who loves to fish, but only succeeds in spearing a junior officer.

ON LOOKING OVER the page proofs of the Vanguard Project issue, we couldn't help but feel that our vivid descriptions might impel some of our readers who are also do-it-yourselfers to whip up a small satellite of their very own.

Very well. Not the ones to inhibit the egos of our readers, we append herewith a useful little formula we came across during our research. It tells you how to figure the distance of your satellite above the earth. How you get it up there is your own problem. We quote this "simple computation" given by a mathematician of the Underwater Sound Laboratory, New London, Conn.

"Equating the centripetal force necessary to keep the satellite in a circular orbit to the gravitational force between the earth and the satellite yields the following equation:

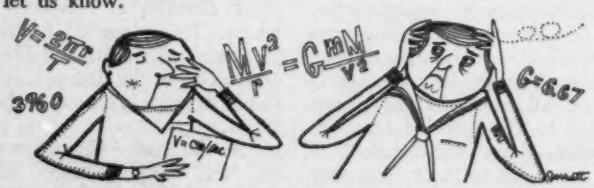
$$\frac{Mv^2}{r} = G\frac{mM}{r^2}$$

where

- m = mass of satellite in grams
- M = mass of earth in grams = 5.983×10^{27} grams
- G = gravitational constant = 6.67×10^{-8}
- r = distance between centers of earth and satellite in centimeters
- v = linear velocity of the satellite in cm/sec.

Introducing $v = \frac{2\pi r}{T}$, where T = period in seconds, the equation is then solved for r, which comes out in centimeters. This value is converted to statute miles. The mean radius of the earth of about 3960 miles is then subtracted."

If there is any error in this computation, we're sure you'll let us know.



A further word of advice: After you achieve success in your modest little endeavor, you may aspire to greater things that will give you a bigger bang. It is strongly recommended that you do NOT (repeat NOT) put to practical application Einstein's well-known formular, $E = mc^2$. The neighbors might object.

★ ★ ★

Showing definite signs of satellite fatigue, our Editor-in-Charge-of-Doggerel-and-Misc.-Matters staggered in at the last minute with *his* contribution to the Vanguard issue. Again, we quote:

Tell me, oh captain
In the future that you see.
What the uniform of the day
On the moon will be.

The All Hands Staff

The United States Navy

Guardian of Our Country

The United States Navy is responsible for maintaining control of the sea and is a ready force on watch at home and overseas, capable of strong action to preserve the peace or of instant offensive action to win in war.

It is upon the maintenance of this control that our country's glorious future depends. The United States Navy exists to make it so.

We Serve with Honor

Tradition, valor and victory are the Navy's heritage from the past. To these may be added dedication, discipline and vigilance as the watchwords of the present and future. At home or on distant stations, we serve with pride, confident in the respect of our country, our shipmates, and our families.

Our responsibilities sober us; our adversities strengthen us.

Service to God and Country is our special privilege. We serve with honor.

The Future of the Navy

The Navy will always employ new weapons, new techniques and greater power to protect and defend the United States on the sea, under the sea, and in the air.

Now and in the future, control of the sea gives the United States her greatest advantage for the maintenance of peace and for victory in war. Mobility, surprise, dispersal and offensive power are the keynotes of the new Navy. The roots of the Navy lie in a strong belief in the future, in continued dedication to our tasks, and in reflection on our heritage from the past. Never have our opportunities and our responsibilities been greater.

ALL HANDS the Bureau of Naval Personnel Information Bulletin, with approval of the Bureau of the Budget on 23 June 1955, is published monthly by the Bureau of Naval Personnel for the information and interest of the naval service as a whole. Opinions expressed are not necessarily those of the Navy Department. Reference to regulations, orders and directions is for information and does not by publication herein constitute authority for action. All original material may be reprinted as desired if proper credit is given ALL HANDS. Original articles of general interest may be forwarded to the Editor.

DISTRIBUTION: By Section B-3203 of the Bureau of Naval Personnel Manual, the Bureau directs that appropriate steps be taken to insure that all hands have quick and convenient access to this magazine, and indicates that distribution should be effected on the basis of one copy for each 10 officers and enlisted personnel to accomplish the purpose of the magazine.

The Bureau invites requests for additional copies as necessary to comply with the basic directive. This magazine is intended for all hands and commanding officers should take necessary steps to make it available accordingly.

The Bureau should be kept informed of changes in the number of copies required.

The Bureau should also be advised if the full number of copies is not received regularly.

Normally copies for Navy activities are distributed only to those on the Standard Navy Distribution List in the expectation that such activities will make further distribution as necessary; where special circumstances warrant sending direct to sub-activities the Bureau should be informed.

Distribution to Marine Corps personnel is effected by the Commandant U. S. Marine Corps. Request from Marine Activities should be addressed to the Commandant.

PERSONAL COPIES: This magazine is for sale by Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Effective 1 Jan 1958, the new rate for All Hands will be: 25 cents per copy; subscription price $2.50 a year, domestic (including FPO and APO addresses for overseas mail); $3.25 foreign. Remittances should be made direct to the Superintendent of Documents. Subscriptions are accepted for one year only.

• AT RIGHT: LOOKING UP—A Naval Observatory telescope searching for more information about far away places in the land of stars took this photo of Orion Nebula.

MEN OF THE WORLD